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Enhancing and assessing group and team learning in architecture and related design contexts

Final Report 2014

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www.teaching-teamwork-in-design.com/index.html
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List of acronyms used

AACA – Architects Accreditation Council of Australia
AIA – Australian Institute Of Architects
ALTC – Australian Learning and Teaching Council Ltd
AQF – Australian Qualifications Framework
CBA – competency-based assessment
DBR – design-based research
DU – Deakin University
EDF – EcoDesign Foundation
IEAust – Institution of Engineers, Australia
IPO – Input-Process-Output
NCSA — National Competency Standards in Architecture
OLT – Australian Government Office for Learning and Teaching
QUT – Queensland University of Technology
RAIA - Royal Australian Institute of Architects
RMIT – RMIT University
SAPA – Self-and-Peer-Assessment
SAPCA – Self-and-Peer-Continuous-Assessment
UniSA – University of South Australia
UoN – The University of Newcastle
UTAS – University of Tasmania
VU – Victoria University
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EXECUTIVE SUMMARY

Teamwork skills are essential in the design industry where practitioners negotiate often-conflicting design options in multi-disciplinary teams. Indeed, many of the bodies that accredit design courses explicitly list teamwork skills as essential attributes of design graduates e.g., the Australian Institute of Architects (AIA), Royal Institute of British Architects (RIBA), the National Council of Architectural Registration Boards (NCARB) of the United States and the Institution of Engineers, Australia (IEAust). In addition to the need to meet the demands of the accrediting bodies, there are many reasons for the ubiquitous use of teamwork assignments in design schools. For instance, teamwork learning is seen as being representative of work in practice where design is nearly always a collaborative activity.

Learning and teaching in teamwork contexts in design education are not without particular challenges. In particular, two broad issues have been identified: first, many students leave academia without having been taught the knowledge and skills of how to design in teams; second, teaching, assessment and assignment design need to be better informed by a clear understanding of what leads to effective teamwork and the learning of teamwork skills. In recognition of the lack of a structured approach to integrating teamwork learning into the curricula of design programs, this project set out to answer three primary research questions:

1. How do we teach teamwork skills in the context of design?
2. How do we assess teamwork skills?
3. How do design students best learn teamwork skills?

In addition, four more specific questions were investigated:

1. Is there a common range of learning objectives for group-and-team-work in architecture and related design disciplines that will enable the teaching of consistent and measurable outcomes?
2. Do group and team formation methods, learning styles and team-role preferences impact students’ academic and course satisfaction outcomes?
3. What combinations of group-and-team formation methods, teaching and assessment models significantly improve learning outcomes?
4. For design students across different disciplines with different learning styles and cultural origins, are there significant differences in performance, student satisfaction (as measured through questionnaires and unit evaluations), group-and-team working abilities and student participation?

To elucidate these questions, a design-based research methodology was followed comprising an iterative series of enquiries:

(a) A literature review was completed to investigate: what constitutes effective teamwork, what contributes to effectiveness in teams, what leads to positive design outcomes for teams and what leads to effective learning in teams. The review encompassed a range of contexts: from work-teams in corporate settings, to professional design teams, to education outside of and within the design disciplines. The review informed a theoretical framework for understanding what factors impact the effectiveness of student design teams.

(b) The validity of this multi-factorial Framework of Effectiveness in Student Design Teams was tested via surveys of educators’ teaching practices and attitudes and of students’ learning experiences. 638 students and 68 teachers completed surveys: two pilot surveys for participants at the four partner institutions, which then informed two national surveys completed by participants from the majority of design schools across Australia.

(c) The data collected provided evidence for 22 teamwork factors impacting team effectiveness in student design teams. Pedagogic responses and strategies to these 22 teamwork factors were devised, tested and refined via case studies, focus groups and workshops.
In addition, 35 educators from a wide range of design schools and disciplines across Australia attended two National Teaching Symposiums. The first symposium investigated the wider conceptualisation of teamwork within the design disciplines, and the second focused on curriculum level approaches to structuring the teaching of teamwork skills identified in the Framework.

The Framework of Effectiveness in Student Design Teams identifies 22 factors impacting effective teamwork, along with teaching responses and strategies that design educators might use to better support student learning. The teamwork factors and teaching strategies are categorised according to three groups of input (Task Characteristics, Individual Level Factors and Team Level Factors), two groups of processes (Teaching Practice & Support Structures and Team Processes), and three categories of output (Task Performance, Teamwork Skills, and Attitudinal Outcomes). Eight of the 22 teamwork factors directly relate to the skills that need to be developed in students, one factor relates to design outputs, and the other thirteen factors inform pedagogies that can be designed for better learning outcomes. In Table 10 of Section 4, we outline which of the 22 teamwork factors pertain to each of five stakeholder groups (curriculum leaders, teachers, students, employers and the professional bodies); thus establishing who will make best use the information and recommendations we make.

In the body of this report we summarise the 22 teamwork factors and teaching strategies informed by the Framework of Effectiveness in Student Design Teams and give succinct recommendations arising from them. This material is covered in depth by the project outputs. For instance, the teaching and assessment strategies will be expanded upon in a projected book on Teaching Teamwork in Design. The strategies are also elucidated by examples of good practice presented in our case studies, and by Manuals on Teamwork for Teachers and Students. Moreover, the project website (<www.teaching-teamwork-in-design.com/index.html>) visited by representatives of stakeholder groups in Australia and Canada, is seeding a burgeoning community of practice that promises dissemination, critical evaluation and the subsequent refinement of our materials, tools, strategies and recommendations. The following three primary outputs have been produced by the project in answer to the primary research questions:

1. A theoretical Framework of Effectiveness in Student Design Teams;
2. Manuals on Teamwork for Teachers and Students (available from the website);
3. Case studies of good/innovative practices in teaching and assessing teamwork in design;

In addition, five secondary outputs/outcomes have been produced that provide more nuanced responses:

4. Detailed recommendations for the professional accrediting bodies and curriculum leaders;
5. Online survey data (from over 700 participants), plus Team Effectiveness Scale to determine the factors influencing effective learning and successful outputs for student design teams;
6. A community of practice in policy, programs, practice and dialogue;
7. A detailed book proposal (with sample chapter), submitted to prospective publishers, on Teaching Teamwork in Design;
8. An annotated bibliography (accessed via the project website) on learning, teaching and assessing teamwork.

The project has already had an international impact. As well as papers presented in Canada and New Zealand, the surveys were participated in by six Canadian schools of architecture whose teaching leaders also provided early feedback on the project aims and objectives during visits made to them by the project leader. In addition, design schools in Vancouver, Canada, and San Diego in the USA have already utilised the Teacher’s Manual and in February 2014, the project findings were discussed at Tel Aviv University in a forum focusing on the challenges for sustainability in architectural education.
PRINCIPAL RECOMMENDATIONS

Analysis of the findings from the literature review, surveys, focus groups, case studies and teaching symposiums has informed 13 recommendations, each specific to one of five stakeholder groups. While it is not pragmatic to provide concise answers to the seven research questions in this summary (for our outputs and recommendations address the questions in great detail and according to intended stakeholder and learning context), the table below indicates which of the 13 recommendations and eight outputs address each of the research questions.

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Relevant Recommendations</th>
<th>Relevant Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How do we teach teamwork skills in the context of design?</td>
<td>3, 4, 5, 7, 8</td>
<td>1, 2, 3, 4, 8</td>
</tr>
<tr>
<td>2. How do we assess teamwork skills?</td>
<td>7, 8</td>
<td>2, 3, 4, 7, 8</td>
</tr>
<tr>
<td>3. How do design students best learn teamwork skills?</td>
<td>8, 9</td>
<td>1, 2, 3, 5, 7, 8</td>
</tr>
<tr>
<td>4. Is there a common range of learning objectives for teamwork in architecture and related design disciplines that will enable the teaching of consistent and measurable outcomes?</td>
<td>1, 2, 5, 11, 12</td>
<td>4, 5</td>
</tr>
<tr>
<td>5. Do team formation methods, learning styles and team-role preferences impact students’ academic and course satisfaction outcomes?</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>6. What combinations of team formation methods, teaching and assessment models significantly improve learning outcomes?</td>
<td>7</td>
<td>2, 5, 7</td>
</tr>
<tr>
<td>7. For design students across different disciplines with different learning styles and cultural origins, are there significant differences in performance, student satisfaction, teamwork abilities and student participation?</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

*Table 1: Seven research questions and their corresponding recommendations and outputs*

Below are the 13 recommendations for the five stakeholder groups. In addition, detailed recommendations for curriculum leaders and professional accrediting bodies are provided in Section 4.2.
Summary of Recommendations

Recommendations for CURRICULUM LEADERS

1. **Design Learning Outcomes**
   Drawing upon the *Framework of Effectiveness in Student Design Teams*, which identifies eight factors directly related to the skills that need to be developed in students, we suggest learning outcomes for all the design disciplines (Table 8).

2. **Architecture Learning Outcomes**
   In the discipline of Architecture, we relate four learning outcomes, one at undergraduate and three at Masters by Coursework level, to Graduate Learning Outcomes, AIA Criteria, National Competency Standards in Architecture (NCSA) Performance Criteria, Course learning Outcomes and the Australian Qualification Framework (Table 9). At the Masters by coursework level, learning outcomes highlight skills and abilities required to perform successfully as a member of multi-disciplinary, ever-changing teams i.e. strategies to practice undertaking specifically defined roles and responsibilities vital in the context of large-scale, multi-level, multi-stakeholder design projects.

3. **Teamwork Skills Development Continuum**
   Teamwork skill development should be staged over the studio design stream based on a developmental continuum (Table 11). Through such a developmental process students should learn to be expert team workers. The continuum can address five levels of skill acquisition (after the Dreyfus model):

   I. **Novice stage** where teamwork theory is introduced, with close supervision or instruction, requiring little conception of dealing with complexity (in pairs or small teams, with simple design briefs), with perception of context where the student tends to see actions in isolation;

   II. **Beginner stage** where a working knowledge of key aspects teamwork theory is demonstrated, with simple design briefs likely to be completed to an acceptable standard (in teams of 3 to 5), requiring some supervision but demonstrating ability to achieve some steps using own judgment, with an appreciation shown of how teamwork might adapt to complex design situations, with perception of context that sees actions as a series of steps;

   III. **Competent stage** where a good working and background knowledge of key aspects teamwork theory is demonstrated, with multifunctional design briefs completed to a good standard (in teams of 3 to 5), showing ability to achieve most tasks using own judgment, coping with complex team challenges through analysis and planning, with perception of context that sees actions in terms of longer goals;

   IV. **Proficient stage** where a thorough understanding of teamwork in practice is demonstrated, with complex designs routinely completed to a good standard (in teams of 3 to 5), demonstrating ability to take full responsibly for own work and that of teammates’, coping in a team with complex design situations holistically through confident decision making, with perception of context that sees the wider picture and how the actions of all teammates fit within it;

   V. **Expert stage** where a deep understanding of teamwork in multi-disciplinary practice is demonstrated, where design excellence is consistently achieved (in teams of 5 to 12), demonstrating ability to take responsibility for innovative team practices, demonstrating an holistic grasp of complex, multi-disciplinary team situations, moving between intuitive and analytical approaches with ease, with perception of context that sees the wider picture and alternative teamwork approaches.
4. **Flexibility**
We suggest incorporating flexibility in the curriculum to facilitate effective teamwork in the context of “Real/Live Community-Oriented Projects,” which often demand adaptation to learning and teaching in relation to real-time factors.

**Recommendations for TEACHERS**

5. **Teaching Teamwork Skills**
Teachers and students agree that the learning of the following teamwork skills: (1) Coordination of tasks and responsibilities; (2) Communication via speaking, writing, drawing, modelling; (3) Idea generation, evaluation and selection; (4) Decision making; (5) Leadership; and (6) Conflict management – leads to consistent and measurable outcomes in relation to successful teamwork, good design outcomes, improved teamwork abilities and positive attitudes to future teamwork. Students therefore need to be taught these six skills. Teachers need also to carefully design assessment and assignments to facilitate and encourage effective teamwork.

6. **Diversity in Teams**
6.1 We recommend asking students to complete a simple learning style test and discussing the results at the outset of teamwork. While students need to be made aware of different learning styles and how they may influence how they themselves and their teammates engage with team assignments, a student’s learning style has little impact on a student’s satisfaction with their team learning experience. However, an awareness in students of how different learning styles can be reflected by teammates’ engagement in different aspects of teamwork, and by the types of task they are best suited to, can prevent conflict by facilitating understanding, empathy and better communication. Students might also be made aware that their learning style, and thus aptitude for teamwork, can affect the attitudes they bring to teamwork. Negative attitudes to teamwork can have detrimental effects on team processes and on student’s satisfaction with design outcomes unless students are mindful of differences between teammates.

6.2 International students should not be isolated with culturally dissimilar teammates, unless they are comfortable with this. Moreover, both the teachers and teammates of international students (especially those non-fluent in the domestic tongue) should be encouraged to acknowledge and compensate for the difficulties these students might have with communication and integration.

7. **Pedagogic Structure**
Task assessment, team formation methods, the use of self-and-peer-assessment, the teaching of teamwork skills, and teaching students how to design in collaboration all significantly impact learning outcomes in team contexts. Thus, these pedagogical factors require careful design in both design and non-design units.

8. **Attending to the 22 teamwork challenges**
We recommend that teachers consider the broad teaching strategies for how to attend to each of the 22 teamwork challenges, offered in Table 5. These strategies are expanded upon in the case studies.

**Recommendations for STUDENTS**

9. **Four simple strategies for effective teamwork**
1. Focus on developing six chief skills essential for effective teamwork – (1) Coordination of tasks and responsibilities; (2) Communication via speaking, writing, drawing, modelling; (3) Idea generation, evaluation and selection; (4) Decision making; (5) Leadership; and (6) Conflict management.
2. Clearly differentiate between groupwork (working together in parallel on individual tasks) and teamwork (collaborating on one assignment) so that everyone has a clear
role that is essential for the team. This can be achieved via a regularly updated project plan that clearly schedules individual and team tasks.

3. Discuss and manage conflict early within the team. Seek help from teachers when conflict reaches a stage that is significantly affecting the team’s outputs and processes.

4. Reflect on team processes regularly – within your team and as an individual – so that you can identify how to improve your teamwork skills. At the end of a team design project, reflect on which teamwork skills you have learned and which you can improve.

**Recommendations for EMPLOYERS**

10. Three simple strategies for improving the effectiveness of design teams

1. Provide continuous professional development opportunities for developing teamwork skills.

2. Encourage team members to reflect in their teams on teamwork experiences and team effectiveness partway through a project and again at its conclusion. This will help improve team processes and ensure that positive attitudes to future teamwork are fostered.

3. Office managers may benefit from conflict management training – which may also be of use in situations outside of office teams.

**Recommendations for PROFESSIONAL ACCREDITING BODIES**

11. The following teamwork competencies, implied by the National Competency Standards in Architecture (NCSA) as being required of an architect, ought to be made explicit:

   - Designing from concept to detail in collaboration with a diverse team consisting of clients, building users, the community, specialists, consultants, manufacturers and suppliers.

   - Managing a project using systems of communication and collaboration to ensure the flow of information, instructions, approvals and agreements between all participants in the design and construction process.

   - Managing a practice using an organisational structure appropriate to the anticipated scope and demand for professional services and which clearly defines the responsibilities of all staff.

12. The Architecture academic standards should be revised to more specifically cover teamwork via either or both of the following options:

   - A rewording of standard 3.1 to “communicating and collaborating with a variety of audiences in appropriate ways.”

   - The addition of a further standard “initiate, negotiate, coordinate and interact with others working, as an effective member or leader of diverse teams, in planning, adapting to and executing design projects.”

We also suggest the addition of the NCSA criteria pertaining to teamwork (6). Thus the Architecture academic standards pertaining to teamwork might better be described as outlined in Table 7.

13. Evidence of a developmental process of teamwork skills learning, in addition to evidence of the appropriate assessment of teamwork skills from Novice to Master, should be required as part of future course accreditation.

Table 2: A summary of the recommendations on learning, teaching and assessing teamwork for the five groups of stakeholders
1. INTRODUCTION

This report is in eight sections. After this introduction is a summary of the (2) Project Aims and then (3) Objectives; including our major research questions, approach, methodology and expected outcomes. We then turn to the key (4) Actual Outputs and Outcomes and how these align with the project aims, research questions and projected outcomes. Next, considered is the (5) Use and Advance of Existing Knowledge through the review of literature and two national teaching symposiums. Next addressed are the (6) Project Dissemination strategies, before finishing with a summary of the (7) Project evaluation & selected factors influencing outcomes, and finally a brief (8) Conclusion.

2. AIMS

Design students are leaving Australian universities without a clear understanding of how to design well in teams. It is recognised that this skills deficit requires an educational shift emphasising collaboration. Such a shift must recognise the teaching implications of differences between two modes of collaborative learning: teamwork and groupwork. The distinction acknowledges the key difference between students collaborating on one assignment (teamwork) and students working together on individual assignments (groupwork). Importantly, in teamwork assignments it is possible to assess students as individuals or to award a team mark, and it has been shown that, in design contexts, whichever of these two assessment models is used has a significant impact on the student learning experience and student evaluations of teaching (Tucker 2008).

Assessment is pivotal in this context because in creative fields students must collaborate in a highly emotive and subjective activity; design. The emotive nature of designing is further charged by the difficulty of assigning authorship to a creative work (such as a building design), which means that ‘free-loading’ (also termed ‘social-loafing’) is difficult to detect. Thus, for students designing in teams it is crucial that they are assessed ‘fairly’ to recognise individual contribution. Indeed, this need is reflected in Understanding Architectural Education in Australasia (Ostwald and Williams 2008, p.38), suggesting that “universities, students and employer groups are not only calling for more groupwork in professional programs, but also for each member of a group to be separately assessed and graded.”

Thus, this project aimed to:

1. Investigate how best to support through teaching and assessment the learning of teamwork skills in architecture and related design disciplines;
2. Propose curricula renewal to include a structured framework for teaching teamwork skills with an associated suite of assessment tools; and
3. Develop and document best-practice models of assessing individual contributions to teamwork within the emotive and highly subjective learning context of creating architecture.

This framework would assist teachers of architecture (and other design and applied arts disciplines) in a number of different ways, including:

- To develop innovative approaches to collaborative studio-based learning in multi-disciplinary and mono-disciplinary contexts;
- To structure groupwork and team design within curricula;
- To develop graduate attributes for teamwork; and
- To assess team design in a consistent, transparent and objective manner to support teamworking skills and increased learner confidence.

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1 In this report, the terms group and team will be used precisely, informed by a differentiation between (1) groupwork – students working in parallel on individually assessed tasks – and (2) teamwork – students collaborating on a task that is either wholly are partly awarded a team mark.
3. OBJECTIVES

3.1 Major Research Questions

The project set out to answer seven primary questions:

1. How do we teach teamwork skills in the context of design?
2. How do we assess teamwork skills?
3. How do design students best learn teamwork skills?
4. Is there a common range of learning objectives for group-and-team-work in architecture and related design disciplines that will enable the teaching of consistent and measurable outcomes?
5. Do group and team formation methods, learning styles and team-role preferences impact students’ academic and course satisfaction outcomes?
6. What combinations of group-and-team formation methods, teaching and assessment models significantly improve learning outcomes?
7. For design students across different disciplines with different learning styles and cultural origins, are there significant differences in performance, student satisfaction (as measured through questionnaires and unit evaluations), group-and-team working abilities and student participation?

3.2 Approach

The structure and methodology of the project was designed to echo the theoretical framework of the 2008 ALTC project Assessing Groupwork in Media and Communication i.e.,

"DBR differs from conventional design and traditional research (in) its emphasis on adapting a design to its local context, a vital attribute for scaling up an innovation successful in one place to many other venues with dissimilar characteristics.”

Thus the project was structured to progress from the survey of existing practices to the testing of these practices leading to refined “good practice.” This process consisted broadly of literature review; review of teaching practices at the partner institutions though focus groups, workshops and online surveys; a symposium for teaching champions to establish overriding issues; the trialling of improved practice at the partner institutions; a national survey of teaching and learning via online surveys; evaluation of good practice, a second symposium discussing how good practices might be implemented across curricula; and finally the evaluation of deliverables and outcomes.

The six broad stages of the project consisted of:

**Stages 1 & 2 Orientation + Review**
- Review practices at partner institutions
- Implement web-based forum
- Develop and circulate pilot surveys to teachers and students at partner institutions
- Identify and differentiate between wider conceptualisations of teamwork across the disciplines via National Teaching Symposium 1

**Stage 3 Refine Practice**
- Analyse partner review to suggest refined teaching and assessment practices
• Analyse pilot surveys data and design national surveys

**Stage 4 Test new models**
• Four partner institutions pilot refined teaching and assessment models then evaluate these practices through focus groups and online surveys

**Stages 5 Measure + Benchmarking**
• Determine impact on the quality of student learning through analysis of feedback to pilots, and through benchmarking against other creative disciplines via national surveys, focus groups, and gap analysis
• Curriculum strategies aligned with professional bodies’ accreditation objectives via National Teaching Symposium 2

**Stages 6 Dissemination + Evaluation**
• Outputs evaluated at partner workshops
• Disseminate findings to relevant stakeholders, independent evaluation, and through the web-based forum

Figure 1 presents an outline of the project major activities throughout these six stages.

**3.3 Expected Outcomes & Outputs**

The project was initiated to create a national resource comprising five interconnected sets of materials to be made available to the sector via a project website and a book (see also Table 3):

1. A theoretical structure for embedding teamwork strategies into Australian curricula
2. Guidelines for the development of teaching models for teamwork in design contexts
3. Guidelines for students to collaborate in groups and teams in design contexts
4. Advice for the professional accrediting bodies and curriculum leaders
5. A community of practice in policy, programs, practice and dialogue
Figure 1: An outline of the project major activities throughout these six stages

- Literature review
- Pilot Surveys designed, ran and analysed
- Review of Pilot Units in Partner Institutions
- Annotated Bibliography
- Project Website
- National Teaching Symposium 1
  - Conceptualising Teamwork and Groupwork in Architecture and related Design Disciplines
- Framework of Effectiveness in Student Design Teams
- National Surveys designed, ran and analysed
- Project Team Workshop 1
  - (Determine refinements)
- Running refined Pilot Units
- Project Team Workshop 2
  - (Reflect on the impacts of refinements)
- National Teaching Symposium 2
  - A Curriculum Level Approach to Teaching Teamwork in Design
- Manuals on Teamwork for Teachers and Students
- Detailed Recommendations for the Professional Accrediting Bodies and Curriculum Leaders
- A Book Proposal on Teaching Teamwork in Design
- Case Studies of Good Practice
- A community of practice in policy, programs, practice and dialogue
4. ACTUAL PROJECT OUTCOMES & OUTPUTS

The project produced eight major outputs and outcomes, which relate to the intended outcomes as indicated in the table below:

<table>
<thead>
<tr>
<th>Actual Project Outcomes &amp; Outputs</th>
<th>Expected Outcomes &amp; Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A theoretical <em>Framework of Effectiveness in Student Design Teams</em>;</td>
<td>1. A theoretical structure for embedding teamwork strategies</td>
</tr>
<tr>
<td>2. Manuals on Teamwork for Teachers and Students;</td>
<td>2. Guidelines for the development of teaching models</td>
</tr>
<tr>
<td>3. Case studies of good practice (plus refined teaching practices at the four partner institutions)</td>
<td>2. Guidelines for the development of teaching models</td>
</tr>
<tr>
<td>4. Detailed recommendations for the professional accrediting bodies and curriculum leaders;</td>
<td>4. Advice for the professional accrediting bodies and curriculum leaders</td>
</tr>
<tr>
<td>5. Survey data and <em>Team Effectiveness Scale</em> to determine the factors influencing effective learning and successful outputs for student design teams;</td>
<td>2. Guidelines for the development of teaching models</td>
</tr>
<tr>
<td>6. A community of practice in policy, programs, practice and dialogue;</td>
<td>5. A community of practice in policy, programs, practice and dialogue</td>
</tr>
<tr>
<td>7. A book proposal, submitted to prospective publishers, on <em>Teaching Teamwork in Design</em>;</td>
<td>2. Guidelines for the development of teaching models</td>
</tr>
<tr>
<td>8. An annotated bibliography (accessed via the project website) on learning, teaching and assessing teamwork.</td>
<td>2. Guidelines for the development of teaching models</td>
</tr>
</tbody>
</table>

*Table 3: Relationship of the projected and achieved project outcomes and outputs*

A further outcome was refined teaching practices at the four partner institutions. The eight major project outputs and outcomes are further described in Sections 4.1 to 4.8. In addition, Table 4 presents a summary of the project workplan, outlining the timeline of major activities and the development of the project outputs.
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Literature Review</td>
<td>Annotated Bibliography (Teaching &amp; Assessing Teamwork)</td>
<td>Project Website developed &amp; updated (Quarterly Newsletters)</td>
<td>Pilot Surveys designed, ran and analysed</td>
<td>Review of Pilot Units in Partner Institutions</td>
<td>National Teaching Symposium 1</td>
<td>PAPER 1</td>
<td>PAPER 2</td>
<td>Framework for Team Effectiveness in Student Design Teams</td>
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</tbody>
</table>

*Table 4: A summary of the project workplan, outlining the timeline of major activities, project outcomes and outputs*
4.1 Framework of Effectiveness in Student Design Teams

The first project output is a theoretical framework, informed by an extensive literature review, for understanding team effectiveness in student design teams. The Framework of Effectiveness in Student Design Teams (Figure 2) is based on the Input-Process-Output (IPO) framework for team effectiveness first proposed by McGrath in the mid-1960s. McGrath’s IPO framework is built upon a basic assumption that the “group” interaction process mediates between input and output (e.g. McGrath 1964; Cummings 1981; Gladstein 1984; Driskell, Hogan et al. 1987).

Three key interrelated categories of input are considered in our framework: (1) task design variables; (2) individual level factors; and (3) team level factors. Task design variables include the types of assignment tasks, their complexity, the structure of tasks (how they relate to each other and their sequences), and the assessment criteria evaluating the quality of outcomes. The task design variables provide the grounds for enactment of individual and team level factors. Individual level factors include the knowledge and skills that students bring to the team project, their learning styles, personalities, attitudes to learning teamwork, as well as their levels of motivation and their expectations. The individual level factors influence team level factors. These Team level factors include leadership approach and role structure, team contracts (establishing rules and norms of teamwork), team composition (i.e. the degree of diversity or homogeneity of teams), climate and cohesiveness.

The three categories of Input influence Output, both directly and indirectly through Team Processes. The group of influences called Team Processes represent internal teamwork processes including: coordination of tasks and responsibilities, communication, idea evaluation, decision-making, and conflict management skills. In addition to team internal processes, the role of external processes is acknowledged under the category of factors called Teaching Practice and Support Structure, which include team formation methods, the explicit teaching of teamwork skills, monitoring and coaching of team processes, and conflict intervention by the teacher. These external processes have direct impacts on individual and team level factors as well as on team processes.

The framework consists of three categories of Output: (1) task performance i.e. the quality of the design submissions and students’ knowledge and skills of the content; (2) teamwork skills i.e. generic teamwork skills and collaborative design skills; and (3) attitudinal outcomes i.e. attitudes to teamwork and motivation for future collaboration. Our framework describes team effectiveness as a dynamic process rather than an end product or end-state (See Ecological Framework of Team Effectiveness, Sundstrom and Altman 1989, Sundstrom, De Meuse et al. 1990). Thus, the two groups of output, teamwork skills and attitudinal outcomes influence the individual level factors of the student’s next cycle of teamwork experience, and through this inform team level factors for subsequent team projects. The broader educational system and curricula structure are considered as the context within which the student team-effectiveness cycle performs (See the model proposed by Kozlowski and Ilgen 2006).

Drawing upon the framework, we have identified 22 factors or challenges impacting on team effectiveness, and 22 corresponding teaching responses and strategies to meet these challenges. These 22 factors and corresponding teaching strategies are listed in Table 5, and expanded upon in the case studies. The viability of the 22-factor model of team effectiveness was evidenced by the national surveys, focus groups and case studies.
Figure 2: Framework of Effectiveness in Student Design Teams
**Teamwork Challenges**

### Task Design Variables

#### 1. Task Structure and Description

| Task structure i.e. duration, sequence and interrelationship of tasks has a considerable influence on team processes. Students should be clear about what is expected with regards to both product (the design artefact) and process (teamwork skills). | • Design task to foster positive interdependence.  
• Structure design assignments to require both independent individual contributions and collaboration.  
• Provide teams with an adequate description of outcomes and processes. |

#### 2. Team Size

| Task structure and assessment need to be considered in relation to the size of team. There can be a relationship between the effectiveness of teamwork processes and team size. | • Explore optimum team size in relation to task type.  
• Promote smaller teams in a ‘conjunctive task’, where every team member needs to contribute, to facilitate equal participation (Watkins 2005).  
• Consider three to five members, unless a large design task can be subdivided into appropriate smaller design packages.  
• Only expand to larger teams (six or above) at Masters level, when students have developed teamwork skills. |

#### 3. Task Assessment Criteria

| Task assessment criteria need to be determined taking into account issues such as assessment of individual contributions, students’ perception of fair assessment and assessment of both product and process of teamwork. | • Differentiate between:  
(1) Task performance i.e. submitted product – usually a designed artefact; and  
(2) Teamwork skills.  
• Adopt appropriate methods of evaluating teamwork processes i.e. students’ reflective statements and self-and-peer-assessment (SAPA).  
• Apply methods to ensure students’ perceptions of fair assessment e.g. the use SAPA. |

### Individual Level Factors

#### 4. Knowledge and Skills

| The differing levels of knowledge and skills in students about the task can influence the team performance and also the comparative performance of teams in cohorts. | • Encourage a variety of skills and prior knowledge in all teams through adopting a teacher-assigned approach to team formation. |
### 5. Learning and Personality Styles

Learning styles of students can be reflected by student engagement in teamwork and may influence the types of task that teammates choose and how well they are able to complete them. The personality type of teammates can affect team processes with regards to many dimensions of communication.

- Encourage a diversity of personality types and learning styles in design teams.
- Ask students to complete a simple learning style test and discuss the results at the outset of teamwork.

### 6. Attitudes and Motivation

Attitudes to teamwork informed by previous experiences can correlate with motivation and thus engagement with team processes.

- Require students to reflect on previous positive and negative experiences of teamwork at the outset of teamwork.

### Team Level Factors

#### 7. Leadership and Role

The leadership approach that student teams adopt and the ways that roles are structured and assigned in a team have impacts on the performance of teams.

- Assist students to assign roles within their teams at regular intervals and at different stages of the design process.
- Encourage students to reflect on their roles at the end of each project stage.
- Require students to discuss appropriate approaches to leadership in their teams.

#### 8. Team Contract and Climate

The team contract, which establishes agreed ways of working together, can inform the leadership approach, role structure, team climate, shared goals and methods for dealing with conflict. Team climate determines how freely teammates are able to share opinions and ideas.

- Assist students to draw up and sign a team contract.
- Promote a team climate of inclusiveness, freedom, interpersonal trust and mutual respect through communicating with students and encouraging them to adhere to the team contract.

#### 9. Team Composition

Team composition including the range of individual differences in terms of age, gender, cultural background, past experience, personality and learning styles not only influences team processes and hence the team performance, but also the comparative performance of teams in cohorts.

- Ensure diversity in teams with regards to gender, culture and past experiences through adopting appropriate team formation methods.
- Provide support for students to cope with diversity in teams.
### 10. Team Cohesion

Team cohesion is defined as “a dynamic process which is reflected in the tendency for a group to stick together and remain united in the pursuit of its goals and objectives” (Carron 1982, p. 124).

- Ensure team cohesion through positive interdependence. In addition to structuring tasks to allow for independent individual contributions and demand design collaboration, you can:
  1. Apply ‘jig-sawing’ team membership (See Frey, Fisher et al. 2009);
  2. Promote student-led reciprocal teaching; and
  3. Encourage the use by teams of project work plans.

### 11. Team Formation

Teachers have two basic ways to form teams: by forming the teams themselves or by allowing students to self-select. Both ways have pros and cons that teachers and students should be aware of.

- Consider forming single-sex teams, if a team cannot have at least two members of one sex.
- For culturally diverse teams, try not to isolate single members of a culture that is different from the rest of their teammates.
- Consider the location or where students live to facilitate out-of-class meetings.
- Closely examine the consequences of team formation methods before adopting one.

### 12. Teaching Teamwork

Students are asked to work in teams in a large proportion of design assignments, but in most cases are taught little if anything about teamwork.

- Teach student both generic teamwork skills and collaborative design skills.
- Provide basic training in teamwork skills for teaching staff.
- Acknowledge the different characteristics of graduate and undergraduate students and determine the teaching style that suits each cohort.

### 13. Process Feedback on Teamwork

Team processes should be monitored continuously so that feedback can be regular and on both the product (the designed artefact) and the team processes that created the product.

- Create interim steps in a team design assignment for discussing individual and team progress.
- Use SAPA or face-to-face discussions regularly as a tool for process feedback encouraging team members to give feedback on their own and their teammates’ performance.

### 14. Conflict Intervention by the teacher

Even when taught conflict resolution skills, students need to be offered intervention strategies for problems that escalate. Teachers can model effective conflict resolution through such

- Offer teams intervention forums and try to resolve conflict at the team level.
- Consider relocating individuals to other teams only as a very last resort e.g. in cases of bullying and harassment.
strategies. Preferably choose a neutral person to resolve the conflict e.g. a teacher who is not assessing the student’s work.

**Team Processes**

**15. Coordination**

The use of project plans (e.g. Gantt charts) produced at the beginning of assignments and then updated at regular intervals is one way to encourage coordination of tasks and responsibilities by teams.

- Encourage teams to coordinate tasks and responsibilities through the use of project plans.
- Require students to submit revised and updated project plans regularly throughout the project. These should be assessed as part of final and interim submissions.
- Gantt charts are a useful medium for recording work plans due to their common use in the construction and other design industries.

**16. Communication**

Interpersonal communication and team building skills are necessary for effectively functioning teams. For design, both oral and drawing interpersonal communications skills are important.

- Require teams to negotiate and agree on mediums and rules of communication.
- Encourage students to consider the advantages of face-to-face communication for complex design negotiations.
- Ensure students devise rules for communication via phone texts that recognise the limits and pitfalls of using it for discussing complex ideas.
- Teach students the importance of graphic communication i.e. how to use thumbnails, diagrams and parts to communicate ideas.

**17. Idea Evaluation**

Idea evaluation in design teams involves generating, evaluating and developing ideas in a manner that is inclusive of all team members.

- Teach students techniques such as brainstorming for generating ideas in teams.
- Teach students how to evaluate, test and refine ideas collaboratively.
- Encourage constructive feedback skills by requiring students to “crit” their own work and the work of other teams.
- Encourage collaborative design interpretation by asking teams to present the work of other teams.

**18. Decision Making**

Decision-making in a team requires an understanding of available strategies and selecting the approach that responds to the team task. The difficulty of making team decisions increases with team size.

- Teach students some common team decision-making models.
- Encourage students to consider models other than democratic decision-making.
- Support students to practice consensus-building skills and reflect on these teamwork processes in team or individual design journals.
19. Conflict Management Skills

Teams need to know how to recognise and productively resolve unhealthy forms of conflict.

- Teach students how to recognise and resolve conflict in a lecture and through a conflict management skills manual.
- Support students to practice conflict management skills via role-play in workshops that recreate conflict scenarios.

Team Output

20. Quality of the Submitted Product (Design) and Learning of Unit-Specific Knowledge and Skills

Task performance is evaluated by the quality of the submitted artefact (design) and the learning demonstrated of course-specific knowledge i.e. the skills and knowledge taught that are NOT related to teamwork (unless teamwork is the primary focus of the course).

- Ask students to differentiate between individual work and teamwork in interim review submissions.
- Ensure the final submissions are team submissions and do not identify individual contributions. Use SAPA to individualise marks by generating multipliers of team marks.

21. Learning of Generic and Collaborative Design Teamwork Skills

Two broad areas of teamwork skills in design include:

- Generic teamwork skills, which are the skills commonly needed for groupwork and teamwork, irrelevant of field e.g. leadership, management, delegation, consensus seeking and the capacity to effectively handle conflict; and
- Collaborative design skills e.g. idea selection and development, shared understanding through graphic communication, and reflective practice (Schön 1987).

- Explore forms of artefact that present teamwork skills and ask students to submit these for assessment.
- Allow students time to work together in class to practice and demonstrate teamwork skills.
- Give students feedback on teamwork skills (preferably by teachers trained in teamwork).

22. Attitudes to Future Teamwork

A significant factor impacting team effectiveness is student attitudes to teamwork, which are heavily informed by previous experiences of teamwork.

- Require students to reflect on their experiences of teamwork in a reflective journal at the completion of assignments.
- Encourage students to reflect on positive team experiences and the strategies that might lead again to these, and of negative team experiences and the strategies that might avoid these in future.
- Require students to consider the skills they have learned and what skills they need to improve.

Table 5: Recommended Teaching Responses & Strategies (Our Framework of Effectiveness in Student Design Teams)
4.2 Manuals on Teamwork for Teachers and Students

The *Manual on Teamwork for Teachers (Appendix A)* was piloted and refined in the four partner institutions. The manual includes four Teaching Modules:

Module 1, *Design and Prepare*, addresses how teamwork should be integrated into a course/unit. Topics considered are: (1) the structure of tasks including the duration, sequence and interrelationship of tasks that student teams should be engaged in; (2) optimum team size in relation to the type of task or team project; (3) task type & complexity; and finally (4) task assessment criteria.

Module 2, *Train and Engage Students*, identifies three issues for teachers: (1) team formation or how to form student teams; (2) providing training for students on generic teamwork skills i.e. collaboration, communication and conflict management skills; and finally (3) teaching of collaborative design skills i.e. brainstorming and idea selection.

Module 3, *Monitor and Support Teams*, considers the need to plan for a support structure throughout the teamwork processes. This structure should include two key components: (1) ongoing process feedback, and (2) conflict management skills support.

Module 4, *Assess and Reflect*, focuses on assessment of team products and processes and addresses issues around final evaluation of and reflection on teamwork experiences i.e. adopting an assessment approach (assigning a team mark or individualising marks) and the pros and cons of different methods of individualising a team mark.

The *Manual on Teamwork for Students (Appendix B)*, also piloted and refined in the four partner institutions, was developed to assist students to learn teamwork skills. It is in seven sections and includes step-by-step guides that help students to start teamwork, communicate constructively, progress effectively and manage conflict. The topics addressed in the manual are:

1. How to start developing a team contract;
2. How to prepare a team project plan;
3. How to run an effective team meeting;
4. How to assign roles and lead a team;
5. How to make team decisions;
6. How to communicate effectively in teams; and
7. How to manage and resolve conflict in team.

The two manuals are most effectively used with teams that work together for longer periods of time e.g. the whole or a major part of a semester. They are less effective for teams that work together for shorter periods.

4.3 Case Studies of Good Practice

In the first year of the project four case studies were selected for study: one in each of the partner universities. These were selected to represent a broad selection of teamwork contexts in relation to: discipline, year level, duration of team assignment, and numbers of students in the teams and class cohorts. The case studies were reviewed on their completion via teachers’ reflective statements and focus groups with students. This qualitative data, in addition to the quantitative data of the pilot surveys, allowed the evaluation of the pedagogies used. The teachers then met at a workshop to devise refinements to the units to be implemented during the second year of the project. The refinements were devised in relation to the 22 factors identified in the Framework.
The teachers then produced descriptions reflecting on the effectiveness of the strategies used in the refined units and how they might be improved. These descriptions are provided in Appendix G, and can be viewed as case studies of good practice for a range of contexts. Table 14 lists the refinements made to each case study in relation to the 22 factors, and also the strategies that were already in place. Further case studies have been identified, from both Canada and Australia, for inclusion in the book *Teaching Teamwork in Design*.

### 4.4 Detailed Recommendations for the Professional Accrediting Bodies and Curriculum Leaders

Teamwork skills are important for all higher education stakeholders. Superior teamwork skills enhance student employability and competitive edge for jobs in the design professions because teamwork is crucial for contemporary design practice. For education providers, reputation, course demand and graduate destination are increasingly shaped by the capacity to develop in students high levels of professional capabilities such as teamwork. Both internal and external accreditation and quality standards requirements increasingly demand evidence of whole-of-course approaches to determining and aligning learning outcomes with discipline specific academic standards and with more general graduate attributes. Evidence is required that such course designs are achieving desired learning outcomes in the key area of teamwork, which is specifically and universally identified as a graduate attribute. Thus demand for teamwork skills in students is driven by five groups of stakeholder - curriculum leaders, teachers, students, employers and the professional body.

Given this demand, we identify here learning outcomes related to teamwork and contextualise these within the specific requirements of stakeholders. We conclude this section by arguing that teamwork skill development can be scaffolded across curricula, specifically over a studio design stream, based on a developmental continuum from novice through to professional mastery.

To identify teamwork learning outcomes for students of architecture and related design disciplines, we have reviewed the academic standards relating to teamwork in the following documents:

- The Architects Accreditation Council of Australia (AACA) *National Competency Standards in Architecture* (NCSA)(AACA 2003);
- The Australian Institute of Architects (AIA) *Policy on Tertiary Education of Architects Standards for Programs in Architecture* (A.I.A. 2008);
- The ALTC Learning and Teaching Academic Standards Statements for: Architecture, the Creative and Performing Arts and Engineering and ICT (ALTC 2010a, ALTC 2010b, ALTC 2011); and
- Our *Framework of Effectiveness in Student Design Teams*.

### 4.4.1 The Architects Accreditation Council of Australia National Competency Standards in Architecture (NCSA)

The Architects Accreditation Council of Australia (AACA) is the national body formed by the registration authorities of each state and territory. AACA is responsible for facilitating the competency-based assessment (CBA) process and maintaining the National Competency Standards in Architecture (NCSA) on behalf of the profession.

The NCSA 2009 recognises four Units of Competency for an architect: Unit 1 – Design, Unit 2 – Documentation, Unit 3 - Project Management, and Unit 4 - Practice Management. Each unit has a number of different Contexts, Elements and Performance Criteria. Thus, Design has 5 Contexts, 16 Elements and 65 Performance Criteria. In all, there are 149 Performance Criteria, under 42 Elements. Australian Architecture courses are accredited in respect of
performance criteria numbers 1–65, 84–95, and 143–149. All other competencies are tested after graduation as part of the architect registration process that occurs through the Architectural Practice Examination in every Australian state and territory. While none of these criteria specifically name teamwork as a required knowledge or skill, 15 Performance Criteria, listed under 12 Elements, at least imply the need for some form of collaboration beyond communication with a client. If we were to consider communication with a client as a form of teamwork, most of the criteria could be said to require teamwork abilities. Table 6 lists 15 Performance Criteria (with associated Units, Contexts and Elements) that we suggest require teamwork skills.

**Detailed Recommendation 1**

Three teamwork competencies are implied by the NCSA as being required of an architect. These are listed in Table 6 with the specific NCSA Units, Contexts, Elements and Performance Criteria with which they can be linked to.

<table>
<thead>
<tr>
<th>Competency</th>
<th>Unit</th>
<th>Context</th>
<th>Element</th>
<th>Performance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Designing from concept to detail in collaboration with a diverse team</td>
<td>Unit 1 Design</td>
<td>1.1</td>
<td>1.1.2,</td>
<td>PC10</td>
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<tr>
<td>consisting of clients, building users, the community, specialists,</td>
<td></td>
<td>1.2</td>
<td>1.2.1,</td>
<td>PC23</td>
</tr>
<tr>
<td>consultants, manufacturers and suppliers.</td>
<td></td>
<td>1.3</td>
<td>1.2.4</td>
<td>PC31</td>
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<td></td>
<td></td>
<td>1.5</td>
<td>1.3.1</td>
<td>PC32</td>
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<td>1.3.2</td>
<td>PC38</td>
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<td>1.3.3</td>
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<td>1.4.1</td>
<td>PC49</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1.5.1</td>
<td>PC54, PC55, PC65</td>
</tr>
</tbody>
</table>

| 2. Managing a project using systems of communication and collaboration to ensure the flow of information, instructions, approvals and agreements between all participants in the design and construction process. | Unit 3 Project Management | 3.1     | 3.1.2   | PC89                 |
|                                                                                                                                   |                          | 3.2     | 3.2.4   | PC104                |

| 3. Managing a practice using an organizational structure appropriate to the anticipated | Unit 4 Practice Management | 4.2     | 4.2.1   | PC126                |
|                                                                                                                                   |                          | 4.2.3   |         | PC127                |
|                                                                                                                                   |                          |         |         | PC129                |

*Table 6: A list of 15 Performance Criteria in NCSA, with associated Units, Contexts and Elements, that imply an architects’ need to demonstrate some form of teamwork skills*

4.4.2 The Australian Institute of Architects Policy on Tertiary Education of Architects: Standards for Programs in Architecture

The AIA lists 63 criteria that “graduates exiting from an undergraduate program shall satisfy.” These are listed in eight knowledge areas: (1) Design Studies and Design Integration, (2) Application and Synthesis, (3) Documentation and Technical Studies, (4) Application and Synthesis, (5) History and Theory Studies, (6) Practice and Project Management, and Implementation and User Studies, (7) Elective Studies and (8) Communication Skills. Two of the 63 criteria relate specifically to teamwork:

3.4 Practice and Project Management, and Implementation and User Studies

3.4.1 Awareness and Knowledge

vi) An understanding of the processes of working within a team and how to collaborate with others in the development of a design solution
3.7 Communication Skills

3.7.2 Application and Synthesis

i) An ability to effect action or communicate ideas through the exercise of skills of collaboration, speaking, writing, drawing, modelling and evaluation

4.4.3 Threshold Learning Outcomes and Academic Standards for Architecture and Related Design Disciplines

Academic standards covering programs of study for Masters of Architecture degrees were developed as part of a demonstration project funded by the Australian Government in 2010-11 and facilitated by the Australian Learning and Teaching Council. Identified are seven academic standards relating to three areas: Knowledge (with two associated standards), Design (two standards) and Professional Practice (three standards). The seven standards are related to the three levels of attainment given in the Australian Qualifications Framework Level 9 for Masters by coursework: (1) Knowledge, (2) Skills, (3) Application of knowledge and skills); and to the NCSA performance criteria numbers 1–65, 84–95, and 143–149. The terms team, teamwork or collaboration appear nowhere in the seven academic standards.

The closest standard to teamwork is 3.1 “communicating with a variety of audiences in appropriate ways.” This standard is related to two AQF Level 9 skills and eight NCSA Performance Criteria. There have been no academic standards written for undergraduate architecture programs. However, we suggest if these are written they might take inspiration from those written for the Creative and Performing Arts, which include among seven undergraduate standards one specifically relating to teamwork: “Work independently and collaboratively in the creative arts discipline in response to project demands.” This is translated at Masters by coursework level as “initiate, lead, negotiate and interact with others in planning, adapting to and executing creative and performing arts projects.”

The standards written for Engineering and ICT include among five standards one specifically relating to teamwork: “communicate and coordinate proficiently by listening, speaking, reading and writing English for professional practice, working as an effective member or leader of diverse teams, using basic tools and practices of formal project management.”

**Detailed Recommendation 2**

Architecture academic standards are revised to more specifically apply to teamwork via either or both of the following options:

- A rewording of standard 3.1 to “communicating and collaborating with a variety of audiences in appropriate ways.”
- The addition of a further standard “initiate, negotiate, coordinate and interact with others, working as an effective member or leader of diverse teams, in planning, adapting to and executing design projects.”

We also suggest the addition of the NCSA criteria pertaining to teamwork in Table 6. Thus the Architecture academic standards pertaining to teamwork might better be described as listed in Table 7.
1.3
Initiate, negotiate, coordinate and interact with others, working as an effective member or leader of diverse multidisciplinary teams, in planning, adapting to and executing design projects

&/or

specialized cognitive and technical skills in a body of knowledge or practice to independently: analyse critically, reflect on and synthesise complex information, problems, concepts and theories; research and apply established theories to a body of knowledge or practice; interpret and transmit knowledge, skills and ideas to specialist and non-specialist audiences

Graduates of a Masters Degree (Coursework) will have communication and technical research skills to justify and interpret theoretical propositions, methodologies, conclusions and professional decisions to specialist and non-specialist audiences

Professional Practice

3.1
Communicating and collaborating

15 The development of the design concept utilises freehand drawings, diagrams, other graphic techniques and modelling (physical and/or computer simulated) to explore three-dimensional form and relationships

16 The design concept is described through drawings and/or three-dimensional representation, computer simulation or other visual and/or written techniques

23 The architectural design demonstrates the process of collaboration and integrates sources of specialist information and expertise

29 The development of the schematic design utilises freehand drawings, diagrams, other graphic techniques and modelling to explore three-dimensional form and relationships

30 Describe the schematic design through drawings and/or three-dimensional representation, computer simulation or other visual and/or written techniques

31 The schematic design proposals are evaluated and tested to enable agreement on selection and commitment to the development of a preferred design

32 The design approach, concept and conditions are articulated to inform a client and other interested parties

33 Client expectations and limitations are reconciled, differences resolved, consequences recognised, alternatives ordered and responsibility for decisions assumed

38 The detailed design interprets, assesses and incorporates information and recommendations provided by consultants, specialists and manufacturers

46 Specialists are consulted as necessary

49 Specialists are consulted as necessary

54 The detailed design demonstrates the integration of specialist information and expertise

55 The detailed design demonstrates continuing consideration of the interests of building users, the community and other relevant groups

56 The development of the detailed design utilises freehand drawings, diagrams, other graphic techniques and modelling to explore three-dimensional form and relationships

57 The detailed design is described through drawings and/or three-dimensional representation, computer simulation or other visual and/or written techniques

65 The ongoing contribution of consultants and suppliers is coordinated

89 Specialist input is identified and obtained

104 Systems are established to ensure the flow of information, instructions, approvals and agreements between all participants
with a variety of audiences in appropriate ways.

126 Knowledge is demonstrated of alternative practice models, such as sole practice, partnership, company, joint-venture, multi-disciplinary, secondary consultancy and networking

127 An appropriate practice structure is established in response to anticipated scope and demand for professional services

129 Staff responsibilities are clearly defined and their understanding ensured

Table 7: The Architecture academic standards pertaining to teamwork, adopted from (AACA 2003, ALTC 2011)

4.4.4 Framework of Effectiveness in Student Design Teams

In our Framework of Effectiveness in Student Design Teams, eight teamwork skills (or areas of knowledge) directly impact the three teamwork outputs of (20) quality of the design; (21) learning of teamwork skills; and (22) attitudes to future teamwork. These eight teamwork skills are indicted in Table 8 in relation to Graduate Attributes, Course Learning Outcomes, and Unit Learning Outcomes. The hierarchy of descriptions incorporates our suggested academic standards and also the AIA criteria.
<table>
<thead>
<tr>
<th><strong>Course Learning Outcome (or Course Aim)</strong></th>
<th><strong>Unit Learning Outcomes (or Learning Objective), Skills &amp; Knowledge</strong></th>
</tr>
</thead>
</table>
| Demonstrates ability to initiate, negotiate, coordinate and interact with others, working as an effective member or leader of diverse, multi-disciplinary teams, in planning, adapting to and executing design projects | **Undergraduate**
1. Demonstrate an understanding of how to collaborate with students of the same discipline in the development of a design solution using the following teamwork skills or areas of knowledge:
   1. Coordination of tasks and responsibilities
   2. Communication via speaking, writing, drawing, modeling
   3. Idea generation, evaluation & selection
   4. Decision making
   5. Leadership
   6. Conflict management
   7. Team theory
   8. Reflective practice to critically analyse your own teamwork skills and attitude to teamwork. |
| **Postgraduate**
1. Demonstrate an understanding of systems of communication and collaboration that ensure flow of information between all participants in all phases of the design process.
2. Demonstrate an understanding of organizational structure and team theory.
3. Demonstrate an ability to design from concept to detail in collaboration with a diverse and multi-disciplinary team using the following teamwork skills:
   1. Coordination of tasks and responsibilities
   2. Communication via speaking, writing, drawing, modeling
   3. Idea generation, evaluation & selection
   4. Decision making
   5. Leadership
   6. Conflict management
   7. Reflective practice to critically analyse your own teamwork skills and attitude to teamwork. |

*Table 8: Eight teamwork skills or areas of knowledge in students that directly impact the three teamwork outputs in relation to Graduate Attributes, Course Learning Outcomes, and Unit Learning Outcomes for Design*
<table>
<thead>
<tr>
<th>AIA Criteria</th>
<th>Australian Qualifications Framework Levels 8 &amp; 9</th>
<th>Unit Learning Outcomes (or Learning Objective) Skills &amp; Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4 Practice and Project Management, and Implementation and User Studies 3.4.1 Awareness and Knowledge vi) An understanding of the processes of working within a team and how to collaborate with others in the development of a design solution 3.7 Communication Skills 3.7.2.2 Application and Synthesis i) An ability to effect action or communicate ideas through the exercise of skills of collaboration, speaking, writing, drawing, modelling and evaluation</td>
<td>Demonstrate ability to initiate, negotiate, coordinate and interact with others working as an effective member or leader of diverse, multi-disciplinary teams, in planning, adapting to and executing design projects</td>
<td>1. Demonstrate an understanding of systems of communication and collaboration that ensure flow of information between all participants in all phases of the design process. 2. Demonstrate an understanding of organizational structure and team theory. 3. Demonstrate an ability to design from concept to detail in collaboration with a diverse and multi-disciplinary team using the following teamwork skills: 1. Coordination of tasks and responsibilities 2. Communication via speaking, writing, drawing, modelling 3. Idea generation, evaluation &amp; selection 4. Decision making 5. Leadership 6. Conflict management 7. Team theory 8. Reflective practice to critically analyse your own teamwork skills and attitude to teamwork.</td>
</tr>
</tbody>
</table>

**Table 9: Recommended learning outcomes in relation to AIA Criteria, NCSA Performance Criteria, Course learning Outcomes and the AQF framework**

Enhancing and assessing group and team learning in architecture
Detailed Recommendation 3
We suggest the learning outcomes listed in Table 8 for all the design disciplines.

Detailed Recommendation 4
In the discipline of Architecture, four learning outcomes, one at undergraduate and three at Masters by Coursework level, can be related to Graduate Learning Outcomes, AIA Criteria, NCSA Performance Criteria, Course learning Outcomes and the AQF framework, as listed in Table 9.

4.4.5 Teamwork Learning Objectives across Curricula

4.4.5.1. Differentiating Pedagogy from Learning Outcomes
Our Framework of Effectiveness in Student Design Teams identifies 22 factors that impact learning in team contexts. As we have shown, eight of these factors directly relate to the skills that need to be developed in students, one factor relates to the design outputs, and the other thirteen factors inform pedagogies that can be designed for better learning outcomes. Before we move on to suggest how the eight teamwork skills might be taught across design streams, we shall differentiate in Table 10 between factors relating to pedagogy, teamwork skills, and design outcomes. We shall also identify which of the 22 factors are relevant to each of the five stakeholders.

4.4.5.2. Teamwork Skills Development across Curricula
A fundamental aim of this project is to inform strategic intervention in design curricula to advance the development and assessment of teamwork skills. While we offer guidance to all teachers of all subjects in all discipline streams across curricula to improve learning in all team contexts, and while different subjects within such streams might emphasise some teamwork skills over others (which have context specific application), we suggest the focus teaching teamwork should be studio design streams. For teamwork is integral to design practice, and the design stream is commonly seen as the backbone of design programs – where knowledge of all discipline streams is applied to designing.

We suggest that teamwork skill development can be scaffolded over the entire studio design stream based on a developmental continuum such as the Dreyfus model of skill acquisition: from Novice to Competence, Proficiency, to Expertise and finally to professional Mastery. The use of such a developmental continuum in tandem with assignments that emphasise some of the 13 pedagogic factors over others, depending on context and level, would facilitate the development of teamwork skills in a gradated, well-supported way.

We have suggested in Table 11 how this might occur. We have differentiated between the five year-levels typical to architecture courses. We have not differentiated between semesters within a year because mid-entry of students (common now to most courses) prevents progressive development over a year. Thus, for instance, we have suggested that at first-year three teamwork skills are introduced at Novice level to teacher-assigned teams of two members only: Communication, Idea Development and Reflection. Then, at second-year level, teacher assigned teams of three to five members (studying within the same discipline) are introduced to four further skills: Coordination, Decision Making, Conflict Management, and Team Theory. At 2nd year teachers need to be mindful of all 13 pedagogic factors. At final-year level, students in multi-disciplinary teams of five to 12 should demonstrate mastery of all eight teamwork skills. At this level, students should have the knowledge to select their own teammates, and should have developed skills making it unnecessary for teachers to use pedagogic scaffolding to support teamwork – apart from appropriate assessment and formative feedback on teamwork processes.
<table>
<thead>
<tr>
<th>FACTORS</th>
<th>STAKEHOLDER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Curriculum leaders</td>
</tr>
<tr>
<td>PEDAGOGICAL FACTORS</td>
<td></td>
</tr>
<tr>
<td>1  Task structure &amp; description</td>
<td>✓</td>
</tr>
<tr>
<td>2  Team size</td>
<td>✓</td>
</tr>
<tr>
<td>3  Task assessment</td>
<td>✓</td>
</tr>
<tr>
<td>4  Knowledge and skills</td>
<td>✓</td>
</tr>
<tr>
<td>5  Learning and personality styles</td>
<td>✓</td>
</tr>
<tr>
<td>6  Attitudes and Motivation</td>
<td>✓</td>
</tr>
<tr>
<td>8  Team contract &amp; climate</td>
<td>✓</td>
</tr>
<tr>
<td>9  Team composition</td>
<td>✓</td>
</tr>
<tr>
<td>10 Team cohesion</td>
<td>✓</td>
</tr>
<tr>
<td>11 Team formation</td>
<td>✓</td>
</tr>
<tr>
<td>12 Teaching teamwork</td>
<td>✓</td>
</tr>
<tr>
<td>13 Process feedback on teamwork</td>
<td>✓</td>
</tr>
<tr>
<td>14 Conflict intervention &amp; teaching</td>
<td>✓</td>
</tr>
<tr>
<td>TEAMWORK SKILLS</td>
<td></td>
</tr>
<tr>
<td>7  Leadership</td>
<td>✓</td>
</tr>
<tr>
<td>15 Coordination</td>
<td>✓</td>
</tr>
<tr>
<td>16 Communication</td>
<td>✓</td>
</tr>
<tr>
<td>17 Idea Evaluation</td>
<td>✓</td>
</tr>
<tr>
<td>18 Decision making</td>
<td>✓</td>
</tr>
<tr>
<td>19 Conflict Management Skills</td>
<td>✓</td>
</tr>
<tr>
<td>21 Learning of Teamwork Skills</td>
<td>✓</td>
</tr>
<tr>
<td>22 Attitudes to Future Teamwork</td>
<td>✓</td>
</tr>
<tr>
<td>DESIGN OUTPUT</td>
<td></td>
</tr>
<tr>
<td>20 Quality of the Design</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Table 10: Factors relating to pedagogy, teamwork skills, and design outcomes*
<table>
<thead>
<tr>
<th>PEDAGOGICAL FACTORS</th>
<th>TEAMWORK SKILLS</th>
<th>Developmental Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Task structure</td>
<td>7. Leadership</td>
<td>Novice</td>
</tr>
<tr>
<td>2. Team size</td>
<td>15. Coordination</td>
<td>Competence</td>
</tr>
<tr>
<td>4. Knowledge &amp; skills</td>
<td>17. Ideation</td>
<td>Expertise</td>
</tr>
<tr>
<td>5. Learning &amp; personality styles</td>
<td>18. Decision making</td>
<td>Mastery</td>
</tr>
<tr>
<td>6. Attitudes &amp; Motivation</td>
<td>19. Conflict management skills</td>
<td>Novice</td>
</tr>
<tr>
<td>7. Leadership</td>
<td>21. Learning team theory</td>
<td>Competence</td>
</tr>
<tr>
<td>8. Team contract &amp; climate</td>
<td>22. Attitudes to future teamwork</td>
<td>Proficiency</td>
</tr>
<tr>
<td>9. Team composition</td>
<td>Teacher Assigned</td>
<td>Expertise</td>
</tr>
<tr>
<td>10. Team cohesiion</td>
<td>Teacher Assigned</td>
<td>Mastery</td>
</tr>
<tr>
<td>11. Team formation</td>
<td>Teacher Assigned</td>
<td>Novice</td>
</tr>
<tr>
<td>12. Teaching teamwork</td>
<td>Teacher Assigned</td>
<td>Competence</td>
</tr>
<tr>
<td>13. Process feedback</td>
<td>Teacher Assigned</td>
<td>Proficiency</td>
</tr>
<tr>
<td>14. Conflict intervention</td>
<td>Teacher Assigned</td>
<td>Expertise</td>
</tr>
<tr>
<td>15. Coordination</td>
<td>Teacher Assigned</td>
<td>Mastery</td>
</tr>
<tr>
<td>16. Communication</td>
<td>Teacher Assigned</td>
<td>Novice</td>
</tr>
<tr>
<td>17. Ideation</td>
<td>Teacher Assigned</td>
<td>Competence</td>
</tr>
<tr>
<td>18. Decision making</td>
<td>Teacher Assigned</td>
<td>Proficiency</td>
</tr>
<tr>
<td>19. Conflict management skills</td>
<td>Teacher Assigned</td>
<td>Expertise</td>
</tr>
<tr>
<td>20. Learning team theory</td>
<td>Teacher Assigned</td>
<td>Mastery</td>
</tr>
<tr>
<td>21. Learning team theory</td>
<td>Teacher Assigned</td>
<td>Novice</td>
</tr>
<tr>
<td>22. Attitudes to future teamwork</td>
<td>Teacher Assigned</td>
<td>Competence</td>
</tr>
</tbody>
</table>

**Table 11: Teamwork Skills Development across Curricula**

Enhancing and assessing group and team learning in architecture 34
Detailed Recommendation 5

Teamwork skill development should be staged over the studio design stream based on a developmental continuum from Novice to Competence, Proficiency, Expertise and finally to professional Mastery (Table 11). Through such a developmental process students should learn to be expert team workers.

Detailed Recommendation 6

Evidence of a developmental process of teamwork skills learning, in addition to evidence of the appropriate assessment of teamwork skills from Novice to Master, should be required as part of future course accreditation.

4.5 Survey Data and Team Effectiveness Scale

4.5.1 Pilot Test Surveys of Student Teamwork Experiences

The pilot surveys for teachers and students primarily served to inform the design of the national surveys. 28 participants from the four partner universities and five from Canadian universities completed the teacher survey. With such a small sample size statistical analysis could reveal no significant data.

196 participants based at the four partner universities completed the student survey. The chief findings from the student survey are presented in Appendix C. Assessment was identified as a key concern of students in the numerical data, with social-loafing identified as primary cause of dissatisfaction with teamwork.

Students were also asked to complete open-ended questions. This qualitative data informed discussions at the first teaching symposium, the structure and coverage of the teacher and student manuals, and the case study refinements. In particular, one question asked students to describe what had led to previous negative teamwork experiences. Eight major reasons emerged from their comments, as presented in Table 12. As can be seen, social-loafing and assessment that did not fairly reflect individual contributions were the greatest causes of dissatisfaction. Further findings from this qualitative data are presented in Appendix C.

<table>
<thead>
<tr>
<th>Reasons for dissatisfaction with teamwork stated in Pilot Survey-2012</th>
<th>No. of Refs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unequal workload (i.e. non-contributing team members)</td>
<td>66</td>
</tr>
<tr>
<td>Unfair assessment</td>
<td>53</td>
</tr>
<tr>
<td>Individual differences between team members</td>
<td>42</td>
</tr>
<tr>
<td>Team process-related Issues</td>
<td>28</td>
</tr>
<tr>
<td>Teaching and task/assignment design</td>
<td>22</td>
</tr>
<tr>
<td>Different expectations &amp; standards of quality between team members</td>
<td>20</td>
</tr>
<tr>
<td>Dominating team members</td>
<td>10</td>
</tr>
<tr>
<td>Too much teamwork</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 12: Qualitative data from the student pilot survey

Assessment was also identified in the national survey as the pedagogical factor that students thought was the most important for teachers to get right. Our manual for teachers therefore includes detailed guidelines on assessment.

The feedback gathered from the qualitative data in the pilot surveys, together with that provided by student focus groups, informed pedagogic changes to the pilot units that had run in the first year of the project. These pedagogic enhancements were designed via a project team workshop and then adopted in refined units run in the second year of the
4.5.2 National Survey of STUDENT EXPERIENCES OF TEAMWORK IN DESIGN & RELATED DISCIPLINES

A primary output of the project has been the development of a survey instrument to test the validity of the Framework of Effectiveness in Student Design Teams.

A 143-item questionnaire, divided into six sections, was used (Table 13). The questionnaire was designed to explore the relationships between the 22 factors of teamwork and: (1) demographics, (2) students’ overall experiences of teamwork at the course level, (3) students’ experiences of teamwork at the subject level, and (4) student learning styles.

The 62 questions of Section 4 establish a Team Effectiveness Scale for measuring effectiveness in student design teams. Table 22 in Appendix D shows the relationships between the 62 questions, the 22 factors and the eight input-output categories. The statistical validity of the scale was evidenced by: (1) the collinear relationship between all 22 factors and the summative question “I was satisfied with the teamwork learning experience;” and (2) the collinear relationship between the 18 input factors and the 3 output factors.

<table>
<thead>
<tr>
<th>Section</th>
<th>Focus</th>
<th>No. of Qs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Student demographics</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Overall experience of teamwork in degree program</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Experience of teamwork in the last course/unit/subject</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Quantitative questions relating to the 22 dimensions of teamwork</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>Qualitative questions on experience of teamwork in last subject</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Questions to establish students’ Kolb learning styles</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 13: Overall Structure of National Survey of “Student Experiences of Teamwork in Design & Related Disciplines”

The survey allowed us to determine the relative importance of the 22 factors by analysing their correlations with ratings for the statement: “I was satisfied with my teamwork learning experiences in this course/unit/subject.” As we might have expected, the three outcomes of teamwork – quality of design, the learning of teamwork skills and future attitudes – most strongly correlated with satisfaction with team learning, for satisfaction with learning might also be considered an output of teamwork. It is worth noting, however, that student satisfaction with their teamwork learning experience more strongly correlated with how highly they rated their learning of teamwork skills than with their satisfaction with design outputs. In a sense, this shows that students valued their learning of teamwork skills above the quality of what they designed, which is an encouraging finding for teachers. Team communication and cohesion were rated by students as the next most important factors. Then came the pedagogic factors, with assessment rated the most important factor for teachers to design well, and the teaching of teamwork, task design and conflict intervention also seen as important.

A full description of the survey instrument and detailed findings (including the relationship of these findings to the recommendation drawn from them) are included in Appendices D and F, respectively.
4.5.4 National Survey of TEAMWORK & GROUPWORK TEACHING & ASSESSMENT SURVEY

The teacher survey was designed to mirror the student survey so that direct comparisons could be made. The main differences between the teacher and student surveys were the demographic questions and the omission of learning styles questions for teachers. A full description of the survey instrument and the detailed findings (including the relationship of these findings to the recommendation drawn from them) are included in Appendices E and F, respectively.2

4.6 A Community of Practice In Policy, Programs, Practice And Dialogue

A Community of Practice is commonly understood to find, share, transfer, and archive knowledge, as well as make explicit context-based experiences not easily captured, codified and stored. The project has fulfilled these aims through a number of mediums and forums of communication. Primarily, we have shared knowledge with the higher education sector globally via a website. This has given professional and accrediting bodies, policy makers, teachers and students ready access to a centralised repository of teaching resources, appraised and selected by an expert team, that are adaptable to different learning contexts. As new resources are developed, the repository will be updated by the project team and also via discussion forums for both teachers and students. The forums will go live via a mail-shot to teaching champions in March of 2014 - following the submission of this final report. The website will therefore be a sustainable and living resource. In line with the recommendations of “Assessing Groupwork in Media and Communication” (Battye, Hart et al. 2008), the community of practice will create linkages between, and provide broad systemic perspective of, the presently separate assessment projects under the ALTC rubric.

The six lifecycle phases of the community of practice are:

- Inquire: through a process of exploration and inquiry via two teaching symposiums attended by around 30 academic champions, and by visits to schools in Australia and Canada, we have identified our audience, purpose, goals, and vision for improved learning of teamwork skills in design education.
- Design: define the team processes and roles that will support the community’s goals via the staged growth of participants at iterative project phases.
- Prototype: pilot the community with a select group of teaching champions to gain commitment, test assumptions, refine the resources, and establish peer-evaluated outcomes.
- Launch: roll out the community to a broader audience over the duration of the project by engaging newcomers through the four online surveys of teachers and learners accessed via the website. As 1,720 students and teachers have viewed the surveys, knowledge of the website is already widespread across Australia.
- Grow: engage members in knowledge sharing activities to create an increasing cycle of participation and contribution; via two national teaching symposiums and three workshops delivered at Deakin, networking events via conferences over the course of the next five years through website bulletins, discussion forums and possible webinars.
- Sustain: Cultivate and assess the knowledge and “products” created by the community to inform new strategies, goals, activities, and roles.

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2 We refer to this as a ‘national’ survey despite the fact that Canadian teachers also participated. This is because this second survey was always intended to be Australia-wide (and is referred to as a “National Survey” in the application) before contact was established with the Canadian schools.
4.7 A Book Proposal on *TEACHING TEAMWORK IN DESIGN*


4.8 An Annotated Bibliography

An early project output was an annotated bibliography and accompanying Endnote library. The bibliography is available via the project website, where it will be regularly updated. The bibliography and Endnote library are intended as a resource for researchers in higher education. The bibliography is a compilation of literature, largely from 2000 to the present, on teamwork and groupwork in the context of practice/workplace and education; including books, sections of edited books, reports, journal papers, conference papers/proceedings, theses and online resources.

The bibliography is divided into eight key themes:

- Collaborative Design Practices and Processes;
- Team Formation/Team Composition;
- Communication;
- Conflict-resolution/Conflict Management;
- Ongoing Assessment & Self and Peer evaluation;
- Information & Communication Technologies;
- Integration into Curricula;
- Other.

Under each category, references are listed alphabetically by title. Abstracts are provided directly from source, and in some cases summaries have been included to better outline the contents. In HTML format, the bibliography will be hyperlinked so that researchers can navigate easily between sections.
Challenges for Effective Teamwork in DESIGN

<table>
<thead>
<tr>
<th>Challenges</th>
<th>DESIGN 2B</th>
<th>ENVIRONMENTAL DESIGN</th>
<th>SUSTAINABLE DESIGN 2</th>
<th>DESIGN STUDIO 4</th>
<th>DESIGN COLLABORATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>It was not addressed or considered.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It was already in place and practiced before.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It was a major refinement to the unit/course.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I. TASK CHARACTERISTICS

1. Task Structure & Description
2. Team Size
3. Task Assessment

II. INDIVIDUAL LEVEL FACTORS

4. Knowledge & Skills
5. Learning Styles
6. Attitudes & Motivation

III. TEAM LEVEL FACTORS

7. Leadership & Role Definition
8. Team Contract & Climate
9. Team Composition
10. Team Cohesion

IV. TEACHING PRACTICES AND SUPPORT STRUCTURE

11. Team Formation
12. Teaching Teamwork
13. Process feedback on teamwork
14. Conflict Intervention by the teacher

V. TEAM PROCESSES

15. Coordination
16. Communication
17. Idea Evaluation
18. Decision Making
19. Conflict Management Skills

VI. TEAM OUTPUTS

20. Quality of Team Product
21. Learning of Teamwork Skills
22. Attitudes to Future Teamwork

Table 14: Refinements to case study units
5. USE & ADVANCE OF EXISTING KNOWLEDGE

In line with the reporting structures of prior OLT/ALTC projects, we discuss here how the project and its outputs have built upon and assimilated existing knowledge. Two primary methods have been used: (1) literature review, and (2) qualitative data collection via two national symposiums attended by teachers with an interest/expertise in teaching teamwork.

5.1 Literature Review

The literature review drew on over 50 years of research from all disciplines; from studies focusing on design practice and education, to higher education as a whole, to research in the field of psychology, to writings on corporate training aimed at increasing the effectiveness of workplace teams. The overriding aim was to identify the characteristics of highly effective teams and the key factors and processes involved in team performance. Outcomes of the literature review included an annotated bibliography, the Framework and the design of the two online survey instruments.

5.2 National Teaching Symposium 1: CONCEPTUALISING TEAMWORK

The first National Teaching Symposium explored questions informed by the literature review, and also by an aim to re-appraise the project aims, objectives, methods and intended outcomes at a stage when refinements might be made. Twenty-four teachers attended representing the disciplines of Architecture, Art and Design, Communications Design, Construction Management, Engineering Design, Graphic Design, Industrial Design, Landscape Architecture, and Theatre Design. Three broad themes emerged.

The first considered the relationships between individuals and teams in design practice. While there was general agreement that individuals still play essential roles, it was acknowledged that complex design projects increasingly rely on the joint contribution and collaboration of different experts. Four key themes emerged from this discussion (Figure 3).

![Figure 3: Themes in relation to the issue of individual versus team in the design practice](image-url)
The second theme considered the acknowledgement of individuals within teams. Most agreed that individual team members may be singled out for both ‘recognition or reward’ and ‘censure, development or counselling.’ Four key themes emerged (Figure 4).

**Figure 4: Themes in relation to acknowledging the contribution of individual students in a team**

The third theme considered pedagogy. It was generally agreed that a combination of teaching teamwork theory and experiential learning is needed to learn teamwork skills and how to be an effective team member. In other words, while theories and abstract ideas about teamwork can be taught in isolation, for theory to become actualised students need to experience working in teams.

5.3 National Teaching Symposium 2: A CURRICULUM LEVEL APPROACH TO TEACHING TEAMWORK

Twelve design educators from 6 higher education institutions attended the second National Teaching Symposium held in July 2013. The symposium focused on the topic of A Curriculum Level Approach to Teaching Teamwork. Four key themes emerged from discussions:

5.3.1 Characteristics of A Curriculum Level Approach To Teaching Teamwork

It was agreed that a curriculum level approach to teaching teamwork is especially appropriate if “the ability to effectively work in teams is thought of as part of the ‘core skills’ of a graduate.” Three key suggestions were made to achieve such an approach:

1. Embedding knowledge, practice and assessment of teamwork in Course Learning Outcomes;
2. Introducing, Developing and Demonstrating specific team skills and abilities in a program of study, instead of allocating a proportion of exercises or tasks to teamwork and groupwork in a single subject unit; and
3. Developing a Community of Practice and/or Knowledge.
5.3.2 Academics’ Attitudes to Student Teamwork

It was recognised that academics generally acknowledge the importance and value of teamwork for students and see teamwork skills as essential for the professional designer. Thus, building teamwork skills is considered as an essential part of design education, even if it may not be addressed or taught explicitly. A key challenge was seen as that of achieving effective and equitable assessment. Additional problems identified were: “minimal focus on teaching teamwork” and “integrating teamwork into a unit mostly as a pragmatic solution to handling large class numbers.” Factors identified as leading to apathy among academics with regards to teaching teamwork included:

1. University policies that discourage or disallow teamwork within major assessment items;
2. A belief that teams tend to ‘carry’ or ‘hide’ under-performers in cohorts;
3. Perceptions of added teaching workload in terms of course and pedagogical development; and
4. The challenge of fair assessment of Individual contributions to team output and process.

A need was identified for a framework and support structures for teachers that includes: (1) plans for professional development; (2) appropriate resources; and (3) case studies of best/innovative practices of teamwork.

5.3.3 Obstacles to Improving Teamwork Learning and Teaching

Obstacles to improvement were broadly divided into two categories: (1) engaging academic staff, and (2) engaging students. A list of the ten key challenges identified is provided in Table 15.

<table>
<thead>
<tr>
<th>Challenges and Obstacles to Teaching and Learning Teamwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Themes From Design Educators’ Comments</td>
</tr>
<tr>
<td>1 Effective &amp; Equitable Assessment</td>
</tr>
<tr>
<td>Ensuring fair and equitable assessment that reflects individual efforts, achievements and learning and mitigates the problem of social-loafing</td>
</tr>
<tr>
<td>2 Students’ Attitudes, Motivation &amp; Engagement in Teamwork</td>
</tr>
<tr>
<td>3 Time Constraints</td>
</tr>
<tr>
<td>4 Lack of proper scaffolding, training and preparation for students</td>
</tr>
<tr>
<td>5 Academics’ attitudes, understanding, skills &amp; knowledge to support teamwork</td>
</tr>
<tr>
<td>6 Additional workloads for academics</td>
</tr>
<tr>
<td>7 Integrating teamwork merely as a pragmatic solution</td>
</tr>
<tr>
<td>8 Challenges facing distance students</td>
</tr>
<tr>
<td>9 Getting multidisciplinary teams work effectively</td>
</tr>
<tr>
<td>10 Ensuring that the momentum of the teamwork is maintained</td>
</tr>
</tbody>
</table>

Table 15: Major themes in relation to the obstacles to teaching and learning teamwork

5.3.4 Motivating Change

It was suggested that academics need advice on developing assessment tasks that allow students to learn and practice teamwork skills, and that they need to feel confident that teamwork skills are scaffolded adequately through degree courses. The three themes identified to motivate change and the encourage engagement of academic staff in relation to these issues are listed in Table 16:
Motivating Changes

<table>
<thead>
<tr>
<th>Themes From Design Educators’ Comments</th>
<th>No. of References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Professional Development and Resources for Teachers on Teaching &amp; Assessing Teamwork</td>
<td>11</td>
</tr>
<tr>
<td>These should include “Appropriate and well-informed Assessment Strategies”, “Strategic &amp; Informed Team Formation Methods” and showcasing case studies of best/innovative practices</td>
<td></td>
</tr>
<tr>
<td>2 Framework for Teaching and Assessing Teamwork Learning</td>
<td>4</td>
</tr>
<tr>
<td>With curriculum mapping across programs, and which should allow a degree of FLEXIBILITY so as not to de-motivate currently successful practices.</td>
<td></td>
</tr>
<tr>
<td>3 A Shared Digital Work Space</td>
<td>2</td>
</tr>
</tbody>
</table>

*Table 16: Themes emerged from design educators’ discussion on the topic of motivating changes to support teaching of teamwork*
6. DISSEMINATION

The dissemination framework followed a multi-phased and multi-pronged plan of progressive communication using conferences, journals, workshops and national teaching symposiums, and a website to be maintained for 3 years following project completion. The six stages of the project and associated evaluation and dissemination strategies are outlined in Table 18.

The project adopted the ALTC Dissemination Framework and drew upon the guide developed by D-Cubed project (Hinton, Gannaway et al. 2011). Two levels of dissemination strategies for this project included Information Provision and Engaged Dissemination strategies. With regard to the Information Provision, the project deliverables were in the form of a project website, reports, guides, journal and conference papers (See Table 19). In addition, Table 18 provides an outline of the major Engaged Dissemination strategies, including those implemented throughout the project and those planned for post project completion.

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Dissemination</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project Orientation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Project member institutions | • Literature Review  
• Designing Pilot Test Surveys  
• Project Website | Literature Review & Pilot Test Survey Instruments were considered and refined by partner investigators and Reference Group (RG) members. |
| 2. Teaching review at partner institutions & National Forum | | |
| All possible stakeholders (Institutions, teachers and students nationally) | • Pilot Units Review & Descriptions  
• Running Pilot Test Surveys  
• National Teaching Symposium 1  
• Paper on Conceptualizing Teamwork  
• Newsletters 1 & 2 | Partner investigators and RG members were engaged in the National Teaching Symposium no.1. |
| 3. Course redesign & staff/student focus groups | | |
| Students and teachers at partner universities and Practice audience | • 1st Drafts of Manuals on Teamwork for Teachers and Students  
• Student Focus Groups at partner institutions  
• Framework of Effectiveness in Student Design Teams  
• Refinements to Pilot Units  
• 1st Draft of Sample Section of the book Teaching Teamwork in Design  
• Newsletters 3 & 4 | In the 1st Project Team Workshop, partner investigators and RG members:  
• Refined Framework of Effectiveness in Student Design Teams and Manuals;  
• Discussed and agreed on a set of refinements in pilot units; and  
• Reviewed Table of Content and Sample Section of the book “Teaching Teamwork in Design”. |
| 4. Piloting restructured courses, student surveys, National Survey | | |
| All possible stakeholders (institutions, teachers and students nationally) | • Paper on Pilot Test Survey findings  
• Designing National Surveys  
• Book Proposal for Teaching Teamwork in Design  
• Newsletters 5 & 6 | Partner investigators and RG members considered and refined National Survey Instruments. |
5: Engaging stakeholder in discussion on key issues

<table>
<thead>
<tr>
<th>All possible stakeholders (Institutions, Teachers and Students Nationally)</th>
<th>National Teaching Symposium 2</th>
<th>Assessing Teamwork Workshop in Deakin Learning Conference</th>
<th>Pilot Units Experiences &amp; Reflections</th>
<th>Newsletters 7 &amp; 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the 2nd Project Team Workshop, partner investigators and RG members:</td>
<td>Reviewed Book Proposal for Teaching Teamwork in Design</td>
<td>Discussed the experiences of refined pilot units</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6: Finalising outcomes and independent evaluation

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner investigators and RG members contributed Pilot Units reflective statements and reviewed the project dissemination.</td>
<td>The independent external project evaluator reviewed the final report and project disseminations.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 17: Project dissemination and evaluation framework across six key phases
### Engaged Dissemination

#### Potential Users and Stakeholders

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Students</th>
<th>Curriculum Leaders</th>
<th>Employers</th>
<th>Professional Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategies to engage with the users throughout the project development, focusing on the intended adoption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- National Teaching Symposia</td>
<td>- National Survey</td>
<td>- National Teaching Symposia</td>
<td>- Project Website</td>
<td>- Project Website</td>
</tr>
<tr>
<td>- Project website</td>
<td>- Project Website</td>
<td>- Project website</td>
<td>- National Teaching Symposia</td>
<td>- Reference group consultation</td>
</tr>
<tr>
<td>- Newsletters</td>
<td>- National Surveys</td>
<td>- Newsletters</td>
<td>- Newsletters</td>
<td>- Reference group consultation</td>
</tr>
<tr>
<td>- National Surveys</td>
<td>- Calls for case studies of good practice</td>
<td>- National Surveys</td>
<td>- Calls for case studies</td>
<td>- Calls for case studies</td>
</tr>
<tr>
<td>- Calls for case studies of good practice</td>
<td>- Conference presentations</td>
<td>- Calls for case studies</td>
<td>- Conference presentations</td>
<td>- Conference presentations</td>
</tr>
<tr>
<td>- Project introductions to 6 Canadian design schools</td>
<td>- Project introductions to 6 Canadian design schools</td>
<td>- Project introductions to 6 Canadian design schools</td>
<td>- Project introductions to 6 Canadian design schools</td>
<td>- Project introductions to 6 Canadian design schools</td>
</tr>
</tbody>
</table>

#### Project outcomes and potential users of outcomes

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Students</th>
<th>Curriculum Leaders</th>
<th>Employers</th>
<th>Professional Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Papers of project findings</td>
<td>- Resources on the Project Website</td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- Make project report available to Professional Bodies</td>
</tr>
<tr>
<td>- Resources on the Project Website</td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
</tr>
</tbody>
</table>

#### Strategies for enabling user-groups become aware of relevant outcomes and use them effectively

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Students</th>
<th>Curriculum Leaders</th>
<th>Employers</th>
<th>Professional Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
<td>- The book <em>Teaching Teamwork in Design</em></td>
</tr>
</tbody>
</table>

#### Strategies to engage with users and obtaining feedback following the project development

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Students</th>
<th>Curriculum Leaders</th>
<th>Employers</th>
<th>Professional Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Post-project workshops (in SA, VIC, NSW, QLD) on Teaching and Assessing Teamwork in Design</td>
<td>- Running refined case studies</td>
<td>- Post-project workshops (in SA, VIC, NSW, QLD) on Teaching and Assessing Teamwork in Design</td>
<td>- Post-project architecture practice managers’ workshop in Melbourne – early 2014.</td>
<td>- Post-project workshop with AIA National Education Committee – mid 2014.</td>
</tr>
<tr>
<td>- Call for post-project case studies of good practice for the book <em>Teaching Teamwork in Design</em></td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Evaluation strategies on the impact of project outcomes with intended user-groups during and following project development

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Students</th>
<th>Curriculum Leaders</th>
<th>Employers</th>
<th>Professional Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Evaluation forms distributed after the workshops</td>
<td>- Survey of Student Experiences before and after implementing refinements to the case studies</td>
<td>- Discussion forums in project website</td>
<td>- Post-project workshop with practice managers of architectural firms in Melbourne – early 2015.</td>
<td>- Post-project workshop with AIA National Education Committee – mid 2014.</td>
</tr>
<tr>
<td>- Examination of refined case studies, incorporating project recommended strategies</td>
<td>- Discussion forums in project website</td>
<td>- Post-project conference workshops (e.g. at Association of Architecture Schools of Australasia (AASA)).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Discussion forums in project website</td>
<td>- Post-project workshops and evaluation surveys at partner institutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Post-project conference workshops (e.g. at AASA).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Table 18: Major Engaged Dissemination Strategies throughout the project and after its completion**
<table>
<thead>
<tr>
<th>Types of Deliverables</th>
<th>Outputs</th>
</tr>
</thead>
</table>
| **D Major reviews** | - Manual on Teamwork for Teachers  
- Manual on Teamwork for Students |
| **K Other academic outputs e.g. websites other than those listed above** | - Project Website: [http://www.teaching-teamwork-in-design.com/](http://www.teaching-teamwork-in-design.com/)  
- OLT Final Report  
- Book proposal for *Teaching Teamwork in Design* |

*Table 19: Project outputs*
7. PROJECT EVALUATION & SELECTED FACTORS INFLUENCING OUTCOMES

To inform future OLT projects, and in line with the reporting structures of prior OLT/ALTC projects, we discuss here the factors that have facilitated and inhibited the project deliverables, and the processes used to evaluate those deliverables.

7.1 Success Factors

Among the factors contributing to the successful achievement of the project deliverables within the specified timeframe and budget are:

- Motivation and engagement of team members from the four partner institutions;
- Continuity of all team members throughout the project life;
- Exemplary and proactive leadership throughout the project;
- Combining the project management and research roles. This gave the research fellow/project manager a comprehensive knowledge and understanding of all project processes;
- Regular weekly meetings of the project leader and research fellow/project manager;
- Regular monthly project-team meetings, via tele- and video-conference, with formal agenda and minutes;
- Two face-to-face one-day project-team workshops at two key stages of the project;
- A diverse mix of team members’ skills, experiences and expertise;
- Clear goals, roles and responsibilities;
- Regular update of the project workplan; specifying tasks, goals/objectives and deadlines;
- Continuous feedback from the project Reference Group on project progress and major outputs;
- Formative feedback from the independent project evaluator at the halfway stage;
- Efficient communication with regular circulation of information and updates.

7.2 Inhibiting Factors

The project team experienced the following inhibiting factors:

- Delay in the recruitment of a research fellow/project manager: we suggest that the search for personnel should begin as soon as a grant has been secured. Recruitment can be a lengthy process, and in the case of this project resulted in a 3-month delay in commencement.
- Encouraging students and teachers to complete surveys: to overcome this challenge incentives were offered for both teachers and students. While the inclusion of an incentive encouraged participation of students, encouraging teachers to complete the online surveys was a major challenge. A change in Ethics
rules at the lead institution means that in future the type of incentive offered, which was to enter a draw for an I-Pad, will no longer be allowed. This means it will become extremely challenging to achieve the numbers of completed surveys needed for meaningful statistical analysis.

- Encouraging students to participate in focus groups: out-of-state visits to institutions by the Research Fellow to hold focus groups proved to be a time- and cost-inefficient method of collecting data, as student participation was very low. In the second year of the project the funds allocated for further focus groups were reallocated to fund two project team workshops. Qualitative data from students was more effectively collected via open-ended questions in online surveys.

7.3 Project Evaluation

The project team committed to a variety of evaluation approaches. This has involved ongoing formal evaluation through regular team meetings, milestone international conference presentations, two national teaching symposiums, two one-day workshops with partners and reference group members, focus groups with students and teachers, comprehensive surveying of teachers and students in Australian and Canadian universities, and an interim independent project evaluation. Experiences with these various forms of evaluation are reported below. A summary of the formal evaluation activities is given Table 17, Section 6.

7.4 Internal Formative Project Evaluation

- Weekly meetings of Project Leader and Project Manager;
- Monthly team meetings with all the partner investigators to discuss formal agenda items, status of tasks, timelines, budget and task allocation;
- Regular circulation of all materials between partner participants, ensuring progression on project deliverables and required timelines for delivery against status of project were reviewed;
- Two project team workshops held in April and November 2013 to facilitate progress on the specific issues of: pilot unit redesign, the sample book chapter, book outline and authorship, book proposal, review of output materials, case study format, and the final report. The programs included each partner institution presenting on key topics, issues for resolution and major findings.

7.5 External Formative Project Evaluation

1. Two presentations at international conferences: in Canada and New Zealand;
2. Project introduction to 6 Canadian universities;
3. Two national teaching symposiums;
4. Milestone circulation of outputs to the Reference Group, whose members were encouraged to provide feedback;
5. Meeting with the Reference Group at first National Teaching Symposium;
6. Submission of a journal paper on the results of the pilot student survey;
7. Submissions to three journal papers and data relating to SAPCA;
8. One-day workshop with the Reference Group in November 2013;
9. Presentation of pedagogic strategies to teaching leaders at Deakin University via one presentation and two workshops;

10. An interim appraisal of the project at the half-way stage by an independent evaluator;

11. A final appraisal of the project at its closing stages by an independent evaluator, timed to allow feedback to inform the final project report.

7.6 Summary of Evaluation Experiences

- Good team participation is important, although individual contributions might vary over time depending on other professional and personal demands and circumstances;
- Energetic team leadership is important to sustain motivation and focus on project outcomes;
- Effective project management is key to ensuring evaluation strategies are coordinated;
- Data collection and analysis must be completed on time and reports made available to inform iterative stages;
- Regular project meetings and milestone events are key forums for sharing expert views and experiences. They enable formative evaluation to be sustained over the life of the project;
- The addition of two face-to-face project team workshops in the last months gave opportunity for timely progression on key objectives;
- Meetings with teaching leaders in Canada provided benchmarking feedback at the beginning of the project, confirming and refining the project aims and objectives. These discussions also resulted in commitments to provide case studies for the book;
- Independent project evaluation at the halfway stage provided invaluable feedback that informed improved processes for the 2nd year of the project;
- The one-day workshop with the reference group a month prior to the writing of the final report provided invaluable feedback on gaps in the project deliverables;
- And last but not least, there is no substitute for lively face-to-face discussion and debate.
8. CONCLUSION

This project sought to: (1) investigate how best to support through teaching and assessment the learning of teamworking skills in architecture and related design disciplines; (2) propose curricula renewal to include a structured framework for teaching teamworking skills; and (3) develop and document best-practice models of assessing individual contributions to teamwork. To elucidate these questions, a design-based research methodology was followed comprising an iterative series of enquiries. A literature review investigated what constitutes effective teamwork, what contributes to effectiveness in teams, what leads to positive design outcomes for teams, and what leads to effective learning in teams. The review informed a multi-factorial Framework of Effectiveness in Student Design Teams, which was tested via surveys of educators’ teaching practices and students’ learning experiences. The data collected provided evidence for 22 factors impacting team effectiveness in student design teams. Pedagogic responses and strategies to these 22 teamwork factors were devised, tested and refined via pilot units, focus groups and workshops for teachers.

In addition to the framework, the following outputs and outcomes were produced: manuals on teamwork to be used for design assignments by both teachers and students; case studies of good practice from the partner institutions informed by the project findings; detailed recommendations for the professional accrediting bodies and curriculum leaders; a Team Effectiveness Scale to determine the factors influencing effective learning and successful outputs for student design teams; a community of practice facilitated through a project website; a book proposal on Teaching Teamwork in Design; and an annotated bibliography (accessed via the project website) on learning, teaching and assessing teamwork.

It is hoped that the long-term, sector-wide impact of the project can be secured via the publication of a book, and via a series of workshops planned for state capitals in 2014.
REFERENCES & BIBLIOGRAPHY


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ALTC (2010a) "Learning and Teaching Academic Standards Statement: Creative and Performing Arts."

ALTC (2010b) "Learning and Teaching Academic Standards Statement: ENGINEERING AND ICT."

ALTC (2011) "Learning and Teaching Academic Standards Statement: ARCHITECTURE."


NCARB (2012). *EDU Education Guidelines*, NCARB.


Appendix A: MANUAL ON TEAMWORK IN DESIGN: FOR STUDENTS

Appendix B: **MANUAL ON TEAMWORK IN DESIGN: FOR TEACHERS**

Appendix C: A Summary of Student and Teacher Pilot Surveys

1. Pilot Test Survey of Student Teamwork Experiences in Design

The items in the survey were informed by the literature review investigating the factors that impact on effectiveness in teams. In Sections 6 and 7, students were asked to rate on a 5-point Likert scale (1 = highly unsatisfied, 5 = highly satisfied) two measures of their satisfaction with teamwork in their most recent team assignment: (1) satisfaction with their teams' team working processes, and (2) satisfaction with the outcome of their teamwork. Respondents were also asked to rate six statements about their learning relating to (1) team size, (2) satisfaction with the teaching they received about teamwork, (3) the level of feedback they received on their team working during the assignment, (4) the method by which their team was formed, (5) whether they considered that the product of their teamwork was fairly assessed to recognise individual contributions to the teamwork, and (6) whether at least one teammate had made little or no contribution to the teamwork.

196 architecture students based at the four partner universities completed questionnaires.

The survey primarily served to inform the design of the national survey. In addition a statistical analysis of the questionnaires revealed the following:

**Team Size**
There was no correlation between team size and student satisfaction with the outcomes and processes of teamwork. As this finding appears to contradict the research suggesting that for conjunctive tasks such as design larger teams are less successful, it is worth noting an important limitation. Namely, that only 15% of the 196 students who answered this question were in teams of five or more. In other words, the vast majority of students surveyed were in teams small enough not be affected by team size.

**Fair Assessment**
How satisfied student were with the outcomes and processes of their teams correlated highly with: (1) the presence of social-loafers in teams, and (2) student perceptions of whether assessment was fair. Moreover, out of the six pedagogic factors considered (team size, fair assessment, free-riders, teamwork teaching, process feedback, and team formation), student perception of whether teamwork fairly assessed individual contribution had the greatest impact on satisfaction with teamwork outcomes and the second greatest impact on satisfaction with teamwork processes.

**Teaching Teamwork**
There were significant correlations between student satisfaction with teaching of teamwork and student satisfaction with both teamwork outcomes and processes. Moreover, satisfaction with teamwork teaching makes the largest unique and significant contribution to satisfaction with teamwork process.

**Process Feedback**
There were significant correlations between levels of process feedback on teamwork and satisfaction with both the outcomes and processes of teamwork;

**Team Formation**
While students in self-selected teams were significantly more satisfied with teamwork processes, there was no significant difference in satisfaction with teamwork outcomes between students in teacher-assigned teams and students in self-selected teams;

**Process and Outcomes**
As might be expected, satisfaction with teamwork processes correlated highly with satisfaction with the outcomes of teamwork.
Students were also asked to complete open-ended questions that gave an opportunity to suggest reasons for negative teamwork experiences. Eight major reasons emerged from their comments, as presented in Table 12.

1. **Social-loafing** and;

2. **Unfair assessment** that did not fairly reflect individual contributions were the two greatest causes of dissatisfaction.

Students generally believed that it was unfair that the same marks were shared between team members when individual contributions were not the same.

The issue of non-contributing team members or uneven workload was suggested to be associated with lack of repercussion and punishment for non-contribution or not holding individual team members accountable for their actions.

3. **Individual differences** in terms of abilities, skills, knowledge and personalities. Difficulties were also seen to result from varied levels of motivation and commitment, different design approaches, and attitudes to teamwork per se.

4. **Team process-related issues** formed the fourth category of contributing factors to negative team experiences. These issues included: (1) difficulty in collaborative decision making (7 references), (2) difficulty with team meetings or getting together as a team (5 references); and (3) other team process-related issues including communication and establishment of team goals (16 references).

5. **Teaching and task/assignment design**, including team formation methods (8 references), large team size (6 references), lack of preparation or training about teamwork skills (4 references) and inappropriate task design (3 references). With regard to team formation methods, students generally complained about teacher-assigned team formation approaches and considered it as a contributing factor to many team challenges e.g. communication, different expectations and varied levels of commitment to team projects.

Students were particularly critical about a lack of about teamwork skills and team processes.

6. **Different expectations and standards of quality** between teammates were identified by twenty students.

7. **Dominating team members** were identified as a problem by ten respondents.

8. **Too much teamwork** in the program was suggested by seven students as leading to negative experiences and attitudes.

2. Pilot Test Survey of Teaching and Assessing Teamwork

Findings revealed that: 71% of teachers stated that there was no curriculum level approach at their institution to determine where the teaching of teamwork takes place, 40% stated that their unit guides contained no learning objectives for teamwork when teamwork was required of students, 84% formed teams by asking students to choose their own teammates, 70% did not teach students how to design in teams. 37% of teachers awarded just team marks, 17% individualised marks and 40% used a combination of both types of assessment. 47% assessed only the product of teamwork, while 53% assessed both process and product. 60% stated that their assessment model was not designed to inform the learning of teamwork skills.
Appendix D: National Survey of STUDENT EXPERIENCES OF TEAMWORK IN DESIGN & RELATED DISCIPLINES


Description
A 143-item questionnaire, divided into six sections, was used (Table 13). The first section of seven questions established student demographics.

The second section of 12 questions (Table 20) asked students to rate (on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree)) their overall experience of team/groupwork in their degree program. This section was divided into 3 parts: Perception & Preferences, Satisfaction with Teamwork, and Attitudes to Teamwork. The section was designed to allow for an exploration of relationships between learning styles, the 22 factors, degree program level, and:
- Preferences for teamwork over individual assignments;
- Preferences for individualised over team marks;
- Satisfaction with grades;
- Satisfaction with the teaching of how to work in teams;
- Satisfaction with the amount of teamwork in course;
- Overall attitudes to teamwork.

Table 20: Qualitative data from the student pilot survey Overall experience of teamwork in degree program

The third section of eight questions (Table 21) established the pedagogical structure of the most recent unit studied that had a major teamwork component.
Enhancing and assessing group and team learning in architecture

### Qs No | Question
---|---
3.1 | Was the course/unit/subject on design?  
3.2 | How long did the group/team assignment last?  
3.3 | What size was the group/team that you worked in?  
3.4 | How were the groups/teams set up?  
3.5 | Were you asked to evaluate your team members’ contributions to teamwork?  
3.6 | Were you asked to evaluate your own contributions to teamwork in comparison to your teammates contributions?  
3.7 | Were you taught about how to WORK in teams?  
3.8 | Were you taught about how to DESIGN in teams?  

**Table 21: Pedagogic structure of unit**

The section was designed to allow for an exploration of the relationships between the pedagogic structure of a course/unit (assignment duration, team size, team formation, use of SAPA, if students were taught teamwork skills) and student experiences in relation to the 22 factors.

The fourth section of the survey with 62 questions was designed to determine student experiences in relation to the 22 factors of *Framework of Effectiveness in Student Design Teams*. Thus, the 62 questions are designed around 22 scales aligned to the 22 factors. At the beginning of the section is a summative question “I was satisfied with the teamwork learning experience” that allows us to determine which of the 22 factors correlate most closely with satisfaction with the learning experience. Table 22 shows the relationships between the 62 questions, the 22 factors and the eight Input-Process-Output categories.

### Qs No | Question | Scale/Factor | IPO Category
---|---|---|---
4.0 | I was satisfied with my teamwork learning experiences in this course/unit/subject |  |  
4.1.1 | The assignment was properly designed and structured for teamwork. | 1. Task Structure & Description |  
4.1.2 | The assignment lasted for the right length of time. |  |  
4.1.3 | The order in which we had to complete tasks for the assignment did NOT allow for effective teamwork. |  |  
4.1.4 | The assignment enabled me to complete some tasks on my own. |  |  
4.1.5 | Members of my team had to work together to complete the assignment. |  |  
4.1.6 | The assignment description made clear what our team should produce and submit (e.g. the design outcome). |  |  
4.1.7 | The assignment description made clear how we should work together as a team. |  |  
4.2 | The assignment was NOT suitable for the size of my team. | 2. Team Size |  
4.3.1 | I am satisfied with the way that our team submission (i.e. design outcome) was assessed. | 3. Task Assessment |  

Input 1: Task Design Variables
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Input 2. Individual level factors</th>
<th>Input 3. Team level factors</th>
<th>Process 1. Teaching practice and support structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.2</td>
<td>I am satisfied with the mark that I received for the team assignment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3.3</td>
<td>I am satisfied with the way that our teamwork skills (i.e. how well we worked as a team) were assessed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3.4</td>
<td>Individual contributions to the teamwork were fairly assessed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3.5</td>
<td>It was useful to evaluate my team members’ contributions to the teamwork.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3.6</td>
<td>Evaluating team members’ contributions helped us work better as a team.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3.7</td>
<td>Assessing my own contributions to the teamwork motivated me to do better next time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4.1</td>
<td>Members of my team had a lot of previous experiences that helped us with the assignments.</td>
<td>4. Knowledge &amp; Skills</td>
<td></td>
</tr>
<tr>
<td>4.4.2</td>
<td>Each team member had about the same level of ability.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4.3</td>
<td>Each team member brought a valuable skill to the team.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5.1</td>
<td>Members of my team had a diverse range of personalities.</td>
<td>5. Learning &amp; Personality Styles</td>
<td></td>
</tr>
<tr>
<td>4.5.2</td>
<td>Members of my team had diverse ways of solving problems and/or designing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6.</td>
<td>I had a positive attitude towards working in a team at the beginning of the project.</td>
<td>6. Attitudes &amp; Motivation</td>
<td></td>
</tr>
<tr>
<td>4.7.1</td>
<td>We set up clear team goals near the beginning of the assignment.</td>
<td>7. Leadership &amp; Role</td>
<td></td>
</tr>
<tr>
<td>4.7.2</td>
<td>The leadership strategies we adopted in our team worked well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.8.1</td>
<td>We agreed on some ground rules of working together.</td>
<td>8. Team Contract &amp; Climate</td>
<td></td>
</tr>
<tr>
<td>4.8.2</td>
<td>I feel that we made a good team.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.8.3</td>
<td>I liked most of the other members of my team.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.8.4</td>
<td>I felt comfortable sharing opinions and ideas with my teammates.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.9.1</td>
<td>There was a diverse range of people in our team with regards to age, gender, and cultural background.</td>
<td>9. Team Composition</td>
<td></td>
</tr>
<tr>
<td>4.9.2</td>
<td>Members of my team had a diverse range of experience and knowledge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.10.1</td>
<td>All members of my team had about the same influence on team decisions.</td>
<td>10. Team Cohesion</td>
<td></td>
</tr>
<tr>
<td>4.10.2</td>
<td>Each team member was needed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.10.3</td>
<td>All members of my team were equally committed to team goals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.10.4</td>
<td>No one slacked off, getting others to do most of the work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.10.5</td>
<td>Members of my team completed their assigned tasks on time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.11.</td>
<td>I am satisfied with the way the teams were formed.</td>
<td>11. Team Formation</td>
<td></td>
</tr>
<tr>
<td>4.12.1</td>
<td>I am satisfied with how much I was taught about teamwork.</td>
<td>12. Teaching Teamwork</td>
<td></td>
</tr>
<tr>
<td>4.12.2</td>
<td>I am satisfied with what we were taught about how to DESIGN in teams.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.12.3 I am satisfied with the teaching we received about decision-making.

4.13. I am satisfied with the feedback I was given on how to improve teamwork skills.

13. Process Feedback

4.14.1 My teachers helped us overcome conflict in our team when we were not able to ourselves.

14. Conflict Intervention by Teachers

4.14.2 I am satisfied with the teaching we received about how to recognise and resolve conflict.

4.15. We regularly coordinated tasks and responsibilities according to a project plan.

15. Coordination

4.16.1 There was no difficulty finding a time when we could all meet.

16. Communication

4.16.2 Members of my team cooperated well with each other.

4.16.3 I am satisfied with the level of interpersonal communication between team members.

4.16.4 Members of my team were able to use drawings to communicate design ideas.

4.17.1 We designed well together as a team.

17. Idea Evaluation

4.17.2 Members of my team were able to generate and develop ideas in a manner that allowed everyone to freely contribute.

4.17.3 I am satisfied with the way that my team evaluated design ideas to make design decisions.

4.18.1 We made decisions democratically i.e. the choices we made were the most popular.

18. Decision Making

4.18.2 We made decisions through open discussion and evaluation of options (i.e. giving every team member a fair chance to be involved in choosing what we considered the best solution to the design problem).

4.19.1 We were able to differentiate between healthy and unhealthy conflict in our team.

19. Conflict Management Skills

4.19.2 I am satisfied with the way that my team dealt with conflict.

4.20.1 I am satisfied with what we handed in.

20. Quality of the design

4.20.2 I am satisfied with how much I learned about the course material.

4.21.1 I am satisfied with the way we worked together as a team.

21. Learning of teamwork skills

4.21.2 The assignment helped me to develop teamwork skills.

4.22.1 I enjoyed the team experience.

22. Attitudes to future teamwork

4.22.2 I felt that working in a team reduced my workload compared to individual assignments.

4.22.3 I would like to work in the same team again.

4.22.4 I look forward to future teamwork because of my experiences of working in this team.

Table 22: Student experiences in relation to 22 factors of Framework of Effectiveness in Student Design Teams

Enhancing and assessing group and team learning in architecture
The ultimate aim of Section 4 is to test a model for determining Effective Teamwork Learning. Towards this end, a factor analysis was made to see if all 22 factors are driven by the same underlying variable. The fifth section of six questions allowed for qualitative answers expanding on issues raised in Section 4 (Table 23).

<table>
<thead>
<tr>
<th>Qs no.</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Do you think that your teachers could have better designed your teamwork assignments? If so, then how?</td>
</tr>
<tr>
<td>5.2</td>
<td>Do you think that the range of individual characteristics that team members brought to your team caused problems? Or were they a benefit? If so, then how?</td>
</tr>
<tr>
<td>5.3</td>
<td>Do you think that you were an effective team? If so, then how? If not, why not?</td>
</tr>
<tr>
<td>5.4</td>
<td>Do you think that the teaching and assessment in your course/unit/subject were good? If not, then why not?</td>
</tr>
<tr>
<td>5.5</td>
<td>Do you think that you worked well together as a team? If not, then why not?</td>
</tr>
<tr>
<td>5.6</td>
<td>Do you think that your team had a problem with conflict? If so, how did you deal with this and what effect did it have?</td>
</tr>
</tbody>
</table>

Table 23: Questions on teamwork learning experiences

The sixth section of 48 questions determined the Kolb Learning Style of students. The Learning Style Inventory (LSI) was first developed by Kolb in 1971 (LSI 1) and revised later in 1985 (LSI 2), in 1993 (LSI 2a), in 1999 (LSI 3) and again in 2005 (LSI 3a). For this study, LSI 2 (Kolb, 1985) was utilised.

Participants and Student Demographics

The online questionnaire was made available to design students at all universities in Australia. 417 completed questionnaires were analysed. Below we represent the demographic data of the sample.

<table>
<thead>
<tr>
<th>1.1 What is your age range?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 20</td>
<td>67</td>
</tr>
<tr>
<td>20 to 25</td>
<td>252</td>
</tr>
<tr>
<td>26 to 30</td>
<td>45</td>
</tr>
<tr>
<td>31 to 35</td>
<td>12</td>
</tr>
<tr>
<td>36 to 40</td>
<td>11</td>
</tr>
<tr>
<td>41 to 45</td>
<td>11</td>
</tr>
<tr>
<td>46 to 50</td>
<td>11</td>
</tr>
<tr>
<td>Above 50</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>417</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2. Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>231</td>
</tr>
<tr>
<td>Female</td>
<td>183</td>
</tr>
<tr>
<td>I'd rather not answer this question.</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>417</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.3. What is the program in which you are enrolled?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>312</td>
</tr>
</tbody>
</table>
Table 24: Student demographics

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Count (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masters (Coursework)</td>
<td>93</td>
<td>22.30%</td>
</tr>
<tr>
<td>Masters (Research)</td>
<td>2</td>
<td>0.48%</td>
</tr>
<tr>
<td>PhD</td>
<td>7</td>
<td>1.68%</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0.72%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>417</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How are you enrolled in this program?</th>
<th>Count (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>366</td>
<td>87.77%</td>
</tr>
<tr>
<td>Part-time</td>
<td>46</td>
<td>11.03%</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>1.20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>417</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Are you?</th>
<th>Count (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic student</td>
<td>347</td>
<td>83.21%</td>
</tr>
<tr>
<td>International student</td>
<td>70</td>
<td>16.79%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>417</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is English your first language?</th>
<th>Count (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>336</td>
<td>80.58%</td>
</tr>
<tr>
<td>No</td>
<td>81</td>
<td>19.42%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>417</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Please specify the name of the institution you are studying at:</th>
<th>Count (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Catholic University</td>
<td>2</td>
<td>0.48%</td>
</tr>
<tr>
<td>Australian National University</td>
<td>2</td>
<td>0.48%</td>
</tr>
<tr>
<td>Central Queensland University</td>
<td>29</td>
<td>6.95%</td>
</tr>
<tr>
<td>Deakin University</td>
<td>148</td>
<td>35.49%</td>
</tr>
<tr>
<td>Griffith University</td>
<td>9</td>
<td>2.16%</td>
</tr>
<tr>
<td>La Trobe University</td>
<td>1</td>
<td>0.24%</td>
</tr>
<tr>
<td>Queensland University of Technology</td>
<td>18</td>
<td>4.32%</td>
</tr>
<tr>
<td>Swinburne University of Technology</td>
<td>17</td>
<td>4.08%</td>
</tr>
<tr>
<td>University of Adelaide</td>
<td>10</td>
<td>2.40%</td>
</tr>
<tr>
<td>University of Canberra</td>
<td>1</td>
<td>0.24%</td>
</tr>
<tr>
<td>University of Melbourne</td>
<td>6</td>
<td>1.44%</td>
</tr>
<tr>
<td>University of Newcastle</td>
<td>17</td>
<td>4.08%</td>
</tr>
<tr>
<td>University of Queensland</td>
<td>39</td>
<td>9.35%</td>
</tr>
<tr>
<td>University of South Australia</td>
<td>2</td>
<td>0.48%</td>
</tr>
<tr>
<td>University of Tasmania</td>
<td>27</td>
<td>6.47%</td>
</tr>
<tr>
<td>University of Technology Sydney</td>
<td>1</td>
<td>0.24%</td>
</tr>
<tr>
<td>University of Western Australia</td>
<td>68</td>
<td>16.31%</td>
</tr>
<tr>
<td>Victoria University</td>
<td>20</td>
<td>4.80%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>417</strong></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E: National Survey of TEAMWORK & GROUPWORK TEACHING & ASSESSMENT


Description
The teacher survey was designed to mirror the student survey so that direct comparisons could be made. The main differences between the teacher and student survey were the demographic questions and the omission of the learning styles questions.

Participants & Teacher Demographics
The online questionnaire was made available to teachers at all universities in Australia, and six universities in Canada. 40 questionnaires were completed and analysed. In Table 25, the demographic data of the sample is presented.

<table>
<thead>
<tr>
<th>1.1 Please choose your institution:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curtin University</td>
<td>1</td>
<td>2.50%</td>
</tr>
<tr>
<td>Deakin University</td>
<td>6</td>
<td>15.00%</td>
</tr>
<tr>
<td>Griffith University</td>
<td>2</td>
<td>5.00%</td>
</tr>
<tr>
<td>Monash University</td>
<td>2</td>
<td>5.00%</td>
</tr>
<tr>
<td>Queensland University of Technology</td>
<td>4</td>
<td>10.00%</td>
</tr>
<tr>
<td>University of Canberra</td>
<td>1</td>
<td>2.50%</td>
</tr>
<tr>
<td>University of Melbourne</td>
<td>4</td>
<td>10.00%</td>
</tr>
<tr>
<td>University of Newcastle</td>
<td>5</td>
<td>12.50%</td>
</tr>
<tr>
<td>University of Queensland</td>
<td>3</td>
<td>7.50%</td>
</tr>
<tr>
<td>University of Sydney</td>
<td>1</td>
<td>2.50%</td>
</tr>
<tr>
<td>University of Tasmania</td>
<td>1</td>
<td>2.50%</td>
</tr>
<tr>
<td>University of Technology Sydney</td>
<td>2</td>
<td>5.00%</td>
</tr>
<tr>
<td>Victoria University</td>
<td>6</td>
<td>15.00%</td>
</tr>
<tr>
<td>Kwantlen Polytechnic university Vancouver</td>
<td>1</td>
<td>2.50%</td>
</tr>
<tr>
<td>Vancouver Canada</td>
<td>1</td>
<td>2.50%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

| 1.2 How long have you been teaching in this institution?|
|--------------------------------------------------------|-----|----------|
| Less than 5 years                                      | 17  | 42.50%   |
| Between 5 to 10 years                                  | 9   | 22.50%   |
| More than 10 years                                     | 14  | 35.00%   |
| **Total**                                              | 40  |          |

<table>
<thead>
<tr>
<th>1.3 Do you teach at?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate level units/courses</td>
</tr>
<tr>
<td>Postgraduate level units/courses</td>
</tr>
<tr>
<td>Both undergraduate and postgraduate level units/courses</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>
1.4 Do you teach a unit/course that requires or encourages students to work in groups or teams?

<table>
<thead>
<tr>
<th>Response</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(If you answer yes to this question, you will be asked about the details of the unit/course in the following pages)</td>
<td>36</td>
<td>4</td>
<td>40</td>
</tr>
</tbody>
</table>

2.1 What is the Year level of unit/course?

<table>
<thead>
<tr>
<th>Year level</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>9</td>
<td>25.71%</td>
</tr>
<tr>
<td>2nd</td>
<td>8</td>
<td>22.86%</td>
</tr>
<tr>
<td>3rd</td>
<td>8</td>
<td>22.86%</td>
</tr>
<tr>
<td>4th</td>
<td>6</td>
<td>17.14%</td>
</tr>
<tr>
<td>5th</td>
<td>2</td>
<td>5.71%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>5.71%</td>
</tr>
</tbody>
</table>

2.2 Is the unit/course?

<table>
<thead>
<tr>
<th>Level</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>25</td>
<td>71.43%</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>8</td>
<td>22.86%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>5.71%</td>
</tr>
</tbody>
</table>

2.3 Is the unit/course?

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design-based (taught largely in the Studio)</td>
<td>19</td>
<td>54.29%</td>
</tr>
<tr>
<td>Theory-based (taught largely in the lecture theatre and tutorials or online)</td>
<td>14</td>
<td>40.00%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>5.71%</td>
</tr>
</tbody>
</table>

2.4 Is the unit/course?

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core (compulsory)</td>
<td>32</td>
<td>91.43%</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
<td>8.57%</td>
</tr>
</tbody>
</table>

2.5 What is the broad discipline area of the unit/course?

<table>
<thead>
<tr>
<th>Discipline Area</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>19</td>
<td>54.29%</td>
</tr>
<tr>
<td>History/Theory</td>
<td>5</td>
<td>14.29%</td>
</tr>
<tr>
<td>Technology/Construction</td>
<td>3</td>
<td>8.57%</td>
</tr>
<tr>
<td>Communications</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Management</td>
<td>2</td>
<td>5.71%</td>
</tr>
<tr>
<td>Professional Practice</td>
<td>2</td>
<td>5.71%</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>11.43%</td>
</tr>
</tbody>
</table>

Table 25: Teacher Demographics
Appendix F: Findings and Recommendations from National Surveys

Although the survey was designed to answer many research questions, we shall limit our analysis in this report to the four major research questions identified at the outset of the project.

**Question 1.** Is there a common range of learning objectives for group-and-team-work in architecture and related design disciplines that will enable the teaching of consistent and measurable outcomes?

In order to answer this question, six skills or areas of knowledge are identified in our *Framework of Effectiveness in Student Design Teams* as factors that directly relate to three outputs of teamwork – (20) quality of design outcome, (21) improved teamwork abilities, and (22) attitudes to future teamwork. The six are indicted in Table 26 in relation to Graduate Attributes, Course Learning Outcomes, and Unit Learning Outcomes.

<table>
<thead>
<tr>
<th>Graduate Learning Outcome (or Attribute)</th>
<th>Course Learning Outcome (or Course Aim)</th>
<th>Unit Learning Outcomes (or Learning Objective), Skills &amp; Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teamwork (Effective Communicator and Team Member)</strong></td>
<td>Demonstrate ability to initiate, negotiate, coordinate and interact with others working as an effective member or leader of diverse, multi-disciplinary teams, in planning, adapting to and executing design projects</td>
<td>I. Demonstrate an understanding of how to collaborate with students of the same discipline in the development of a design solution using the following teamwork skills or areas of knowledge:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Coordination of tasks and responsibilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Communication via speaking, writing, drawing, modelling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Idea generation, evaluation &amp; selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Decision making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Leadership</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Conflict management</td>
</tr>
</tbody>
</table>

*Table 26: Six skills in Framework of Effectiveness in Student Design Teams in relation to Graduate Attributes, Course Learning Outcomes, and Unit Learning Outcomes*

**Finding: Student Survey**

For students, there is a common range of teamwork skills that enable the learning of consistent and measurable outcomes. Thus, the learning of the skills of: (1) Coordination of tasks and responsibilities; (2) Communication via speaking, writing, drawing, modelling; (3) Idea generation, evaluation & selection; (4) Decision making; (5) Leadership; (6) Conflict management; has a significant impact on:

- Satisfaction with the teamwork learning experience
- The quality of design outcomes
- Improved teamwork ability
- Attitudes to future teamwork
Communication and Idea Evaluation were seen to have the greatest impact on all four outcomes above.

**Finding: Teacher Survey**
Five teamwork skills were seen as important for effective teamwork. The order of importance was: (1) Communication, (2) Decision Making, (3) Coordination, (4) Leadership and (5) Design Evaluation. Notably, the first three of these skills were seen as more important than teaching students: teamwork skills, and how to design collaboratively.

**Recommendation**
The learning of – 1) Coordination of tasks and responsibilities; (2) Communication via speaking, writing, drawing, modelling; (3) Idea generation, evaluation & selection; (4) Decision making; (5) Leadership; and (6) Conflict management – leads to consistent and measurable outcomes in relation to successful teamwork, good design outcomes, improved teamwork abilities and positive attitudes to future teamwork. Students therefore need to be taught these six skills.

**Question 2.** Do group and team formation methods, learning styles and team-role preferences impact students’ academic and course satisfaction outcomes?

In order to answer these questions, the relationships were analysed between learning styles, three course level questions, eight questions relating to pedagogic structure, and three factors of *Framework of Effectiveness in Student Design Teams*.

**Finding: Student Survey**
1. The team formation method adopted, the size of teams and student learning-styles do not impact on student satisfaction with their learning experience. It should be noted that 88% of the students surveyed worked in teams of between 3 or six students, which is what we would generally recommend.
2. A student’s overall preference for either working in teams or individually will significantly impact their teamwork learning experience.

**Recommendation**
i) While students need to be made aware of different learning styles and how they may influence how they themselves or their teammates engage with team assignments, a student’s learning style has little impact on a student’s satisfaction with their team learning experience.

ii) Whether students work in teams of three, four, five or six has no significant impact on a student’s team learning experience. However, we recommend that teams should only be larger than six for complex projects at the latter stages of Masters courses.

iii) Team formation method has no significant impact on a student’s team learning experience. However, we recommend that some form of strategy be adopted to facilitate diversity in teams.

**Question 3.** What combinations of group-and-team formation methods, teaching and assessment models significantly improve learning outcomes?

To answer this question we looked at the effect of eleven pedagogic variables on seven learning outcomes.

**Finding: Student Survey**
- Student’s teamwork learning outcomes did not differ between design and non-design units.
- Student’s teamwork learning outcomes did not differ between those in teacher-assigned teams and those in student-assigned teams. However, satisfaction with team formation did significantly correlate with seven learning outcomes. These apparently conflicting findings
suggest perceptions of well-designed team formation methods were important but the actual method of team formation used was not. This would seem to align with our own recommendations that the most important aspect of team formation is that the method is appropriate to context, and the reasons for its use are transparent and clearly explained.

- The use of self-and-peer-assessment significantly positively impacts numerous measures of successful learning outcomes.
- Student’s teamwork learning outcomes across all measures were significantly improved when students were taught teamwork skills.
- Student’s teamwork learning outcomes across all measures were significantly improved when students were taught how to design collaboratively.
- The duration of team projects and size of teams had no impact on learning outcomes.
- Satisfaction with task assessment, team formation and the teaching of teamwork significantly correlated with all measures of learning outcomes.

**Recommendation**

Task assessment, team-formation methods, the use of self-and-peer-assessment, the teaching of teamwork skills, and teaching students how to design collaboratively all have significant impacts on learning outcomes in team contexts. Thus, these pedagogical factors require careful design in both design and non-design units.

**Question 4.** For design students across different disciplines with different learning styles and cultural origins, are there significant differences in performance, student satisfaction, group-and-team working abilities and student participation?

In order to answer this question, the relationships were analysed between cultural demographics, learning styles, and eight learning outcomes.

**Finding: Students**

While design outcomes are not effected by the cultural origin of students, other learning outcomes related to teamwork experiences are significantly less positive for students of non-English background, with those who do not claim English as their mother tongue particular effected. Moreover, our analysis of SAPCA ratings shows that home students rate the team contributions of non-domestic students significantly lower, even when there is no significant difference in design abilities between the two groups. Satisfaction with design outcomes and the attitudes to teamwork that students bring to design assignments differ between students of different learning styles. Convergent learners in particular are significantly worse off.

**Finding: Teachers**

There appear to be difference in learning outcomes for students between disciplines.

**Recommendation**

i) An awareness in students of how different learning styles can be reflected by teammates’ engagement in different aspects of teamwork, and by the types of task they are best suited to, can prevent conflict by facilitating understanding and better communication. Students might also be made aware that their learning style, and thus aptitude for teamwork, can affect the attitude they bring to teamwork, which can have negative effects on team processes and on student’s satisfaction with design outcomes unless students are mindful of differences between them. We recommend asking students to complete a simple learning style test and discussing the results at the outset of teamwork.

ii) International students should not be isolated in culturally different teams, unless they are comfortable with this. Moreover, both the teachers and teammates of international, and
especially non-English speaking, students should be encouraged to acknowledge and compensate for the difficulties these students might have with communication and integration.

**Question 5(a).** For students, what is the relative importance of the 22 factors for effective teamwork?

To answer this, we analysed the correlations of the 22 dimensions and ratings for the statement: “I was satisfied with my teamwork learning experiences in this course/unit/subject.” All 22 dimensions significantly correlate with satisfaction with teamwork learning experience, thus supporting the viability of our model of team effectiveness. Table 27 ranks the importance of the 22 dimensions.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Factors</th>
<th>Correlation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>22. Attitudes to Future Teamwork</td>
<td>.618</td>
<td>.000**</td>
</tr>
<tr>
<td>2.</td>
<td>21. Learning of Teamwork Skills</td>
<td>.590</td>
<td>.000**</td>
</tr>
<tr>
<td>3.</td>
<td>20. Quality of the Design</td>
<td>.541</td>
<td>.000**</td>
</tr>
<tr>
<td>4.</td>
<td>16. Communication</td>
<td>.537</td>
<td>.000**</td>
</tr>
<tr>
<td>5.</td>
<td>10. Team Cohesion</td>
<td>.530</td>
<td>.000**</td>
</tr>
<tr>
<td>6.</td>
<td>17. Idea Evaluation</td>
<td>.516</td>
<td>.000**</td>
</tr>
<tr>
<td>7.</td>
<td>3. Task Assessment</td>
<td>.492</td>
<td>.000**</td>
</tr>
<tr>
<td>8.</td>
<td>4. Knowledge &amp; Skills</td>
<td>.483</td>
<td>.000**</td>
</tr>
<tr>
<td>9.</td>
<td>12. Teaching Teamwork</td>
<td>.477</td>
<td>.000**</td>
</tr>
<tr>
<td>10.</td>
<td>1. Task Structure &amp; Description</td>
<td>.456</td>
<td>.000**</td>
</tr>
<tr>
<td>10.</td>
<td>8. Team Contract &amp; climate</td>
<td>.456</td>
<td>.000**</td>
</tr>
<tr>
<td>12.</td>
<td>15. Coordination</td>
<td>.449</td>
<td>.000**</td>
</tr>
<tr>
<td>13.</td>
<td>14. Conflict Intervention by Teachers</td>
<td>.435</td>
<td>.000**</td>
</tr>
<tr>
<td>14.</td>
<td>19. Conflict Management Skills</td>
<td>.433</td>
<td>.000**</td>
</tr>
<tr>
<td>15.</td>
<td>16. Team Formation</td>
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<td>.000**</td>
</tr>
<tr>
<td>16.</td>
<td>7. Leadership &amp; Role</td>
<td>.383</td>
<td>.000**</td>
</tr>
<tr>
<td>17.</td>
<td>13. Process Feedback on Teamwork</td>
<td>.379</td>
<td>.000**</td>
</tr>
<tr>
<td>18.</td>
<td>18. Decision Making</td>
<td>.356</td>
<td>.000**</td>
</tr>
<tr>
<td>19.</td>
<td>2. Team Size</td>
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<td>.000**</td>
</tr>
<tr>
<td>20.</td>
<td>5. Learning Styles</td>
<td>.239</td>
<td>.000**</td>
</tr>
<tr>
<td>21.</td>
<td>6. Attitudes &amp; Motivation</td>
<td>.123</td>
<td>.006*</td>
</tr>
<tr>
<td>22.</td>
<td>9. Team Composition</td>
<td>.103</td>
<td>.018*</td>
</tr>
</tbody>
</table>

Table 27: The relative importance of the 22 factors for effective teamwork, for STUDENTS

**Finding: Students**

As we might have expected, the three outcomes of teamwork – quality of design, the learning of teamwork skills and future attitudes – most strongly correlated with satisfaction with team learning, for satisfaction with learning might also be considered an output of teamwork. Communication and cohesion were the next highest rated factors. Then comes pedagogy, with assessment, the teaching of teamwork, task design and conflict intervention by teachers seen as important.
**Question 5(b).** For teachers, what is the relative importance of the 22 factors for effective teamwork?

We asked teachers to rate the importance to effective teamwork of the 19 factors of *Framework of Effectiveness in Student Design Teams* (See Table 28).

<table>
<thead>
<tr>
<th>Rank</th>
<th>Factors</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Communication</td>
<td>6.59</td>
</tr>
<tr>
<td>2.</td>
<td>Team cohesion</td>
<td>6.28</td>
</tr>
<tr>
<td>3.</td>
<td>Decision making</td>
<td>6.23</td>
</tr>
<tr>
<td>4.</td>
<td>Coordination</td>
<td>6.18</td>
</tr>
<tr>
<td>5.</td>
<td>Team Contract and climate</td>
<td>6.15</td>
</tr>
<tr>
<td>6.</td>
<td>Task structure &amp; description</td>
<td>6.00</td>
</tr>
<tr>
<td>7.</td>
<td>Team size</td>
<td>5.87</td>
</tr>
<tr>
<td>8.</td>
<td>Task assessment</td>
<td>5.72</td>
</tr>
<tr>
<td>9.</td>
<td>Conflict Intervention by teachers</td>
<td>5.62</td>
</tr>
<tr>
<td>10.</td>
<td>Conflict management skills</td>
<td>5.62</td>
</tr>
<tr>
<td>10.</td>
<td>Leadership &amp; role definition</td>
<td>5.51</td>
</tr>
<tr>
<td>12.</td>
<td>Process feedback on teamwork</td>
<td>5.51</td>
</tr>
<tr>
<td>13.</td>
<td>Teaching teamwork</td>
<td>5.50</td>
</tr>
<tr>
<td>14.</td>
<td>Idea evaluation</td>
<td>5.44</td>
</tr>
<tr>
<td>15.</td>
<td>Attitudes and motivation</td>
<td>5.31</td>
</tr>
<tr>
<td>16.</td>
<td>Team formation</td>
<td>5.28</td>
</tr>
<tr>
<td>17.</td>
<td>Knowledge &amp; Skills</td>
<td>5.13</td>
</tr>
<tr>
<td>18.</td>
<td>Team composition</td>
<td>5.06</td>
</tr>
<tr>
<td>19.</td>
<td>Learning styles</td>
<td>5.00</td>
</tr>
</tbody>
</table>

*Table 28: The relative importance of the 22 factors for effective teamwork, for TEACHERS*

**Finding: Teachers**

Teachers see team process dimensions such as communication, decision-making and coordination with the related dimensions of team climate and team cohesion as the most important factors for effective teamwork. The pedagogic dimension were the next important – task structure, team size, assessment and conflict intervention. Team formation, and the characteristics of teams and their members – composition, students’ knowledge and skills and learning styles – were the least important.

**Question 5(c).** Are there significant differences between students’ and teachers’ perceptions of what factors lead to effective teamwork.

**Finding**

There were remarkable similarities between what teachers and students thought were the important factors for effective teamwork and team learning. Both groups rated teamwork skills and then task design and assessment as the most important, and team composition and the characters of team members as the least important factors for successful outcomes. The major differences were that teachers saw decision-making and team size as
important while students did not, and students rated design evaluation and being taught teamwork skills much more highly than teachers did.

Recommendation
Teachers see teamwork skills – such as communication, decision-making, coordination, the use of team contracts and task schedules – together with team cohesion as the most important factors for effective teamwork. Students therefore need to be taught these skills when asked to design in teams. Teachers need also to carefully design assessment and tasks to facilitate and encourage effective teamwork.
Appendix G: Case Studies

DESIGN 2B, Case Study in Deakin University

Learning Objective/s related to Teamwork Skills
An understanding of the processes of working within a team and how to collaborate with others in the development of a design solution.

The major focus is the relationship between sustainable design and tectonics through a series of interrelated design projects. Areas of exploration include: the use of diagram to communicate ideas, site analysis, ecologically sustainable building and designing collaboratively as part of a team. Design is explored across a broad range of scales, and includes representational and simulated modelling. Consideration is given to cultural, social, material and environmental requirements and the importance of historical precedent. The unit reinforces understandings of passive heating, cooling and daylighting as well as consideration of structural, constructional and envelope systems.

<table>
<thead>
<tr>
<th>Unit no.</th>
<th>Year level</th>
<th>U/G P/G</th>
<th>No. of Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design 2B</td>
<td>2nd year</td>
<td>U/G</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASSIGNMENT</th>
<th>% unit marks</th>
<th>% Groupwork</th>
<th>% Teamwork</th>
<th>% Individual</th>
<th>SAPA (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precedent</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>N</td>
</tr>
<tr>
<td>Domus</td>
<td>35</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>Y</td>
</tr>
<tr>
<td>Test &amp; Refine</td>
<td>40</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>Y</td>
</tr>
<tr>
<td>Reflective Journal</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>N</td>
</tr>
</tbody>
</table>

III. TEAM LEVEL FACTORS

SIGNIFICANT PEDAGOGIC INTERVENTION

10. Team Cohesion: A “home-team/expert-team” strategy is adopted to encourage “interdependency”. Thus, for each individual research task for the beginning stages of design, students join expert teams to discuss one of five research topics. The expert teams consisted of students addressing the same topic for the same site. In this way every student in every team develops an individual expertise and role that is essential to the team.

IV. TEACHING PRACTICES AND SUPPORT STRUCTURE

SIGNIFICANT PEDAGOGIC INTERVENTION

12. Teaching Teamwork: Teamwork skills are also taught via the following methods:

- A ‘Manual on Teamwork’ addressing essential issues of teamwork;
- Studio teaching and tutorials focusing on how design is negotiated in a team i.e. producing minutes and work-plans;
- A workshop on teamwork skills i.e. generic teamwork skills and collaborative design skills (graphic brainstorming techniques to generate, evaluate and develop design ideas collaboratively); and
- Lectures on teamwork theory, teamwork in professional practice, conflict resolution and managing emotions in team conflicts.

14: Conflict Intervention by the teacher: A teacher was dedicated to the task of resolving conflict difficulties that are NOT related to design. Students are informed that while the tutorials were the place where design conflict should be discussed, if issues arose outside
of that sphere the conflict management teacher is available to help. This teacher is not involved in the assessment of the design work so that students can talk openly and frankly about conflict without the fear that their difficulties might be taken into account in the evaluation of their teamwork skills.

VI. TEAM OUTPUTS

SIGNIFICANT PEDAGOGIC INTERVENTION

21: Learning of Teamwork Skills: Students were required to submit ‘graphic reflective journals’ in which they are asked to reflect on: 1. The strategies they have adopted and on what they have learned with regards to five dimensions of Team Processes; 2. Their teamwork experiences i.e. how negative experiences might be avoided and how positive experiences might be repeated next time.

22: Attitudes Towards Future Teamwork: In addition to being used to assess teamwork skills, the graphic reflective journals are aimed at encouraging a more positive view of students’ experiences for future teamwork assignments. Thus, students are asked in the journals to reflect on positive and negative experiences of teamwork.

OUTCOMES

10. Team Cohesion: The use of jig-sawing and expert teams at the beginning of the design project clearly delineated groupwork roles for some of the early research tasks such as precedent, climate and site analyses. Student’s established expertise in these areas and thus had essentials roles in their teams. However, as this groupwork was unassessed, only about 70% of students participated. Moreover, jig-sawing again later in the design phase could have reinforced the groupwork roles. The expert teams were only used once, which means their impacts were short-lived.

12. Teaching Teamwork: The Manual on Teamwork formed the structure for the teamwork workshops, which improved the workshops and engagement with the materials. Encouraging students to engage with the Manual (or similar structured teamwork guidelines and resources) again for the reflective journal assignment may maximize its benefits for teaching students teamwork skills.

14: Conflict Intervention by the teacher: This proved a successful method of helping a handful of teams overcoming the type of interpersonal conflict that in the past may have had a serious or irreparable impact on teamwork and team outcomes. One team in particular was able to overcome difficulties that at the interim review had resulted in poor design outcomes. Resolving these difficulties strengthened cohesion to such an extent the team’s design was one of the most highly evaluated at the final review. However, conflict intervention is difficult to manage and confronting for students and teachers. Training for teachers in conflict management would greatly help.

21: Learning of Teamwork Skills: Requiring students to submit reflective journals proved to be a successful addition making it possible to assess learning of teamwork skills. However, only about 75% of students submitted because the journal was only 10% of the total assessment. The value of the reflective journal should be increased to increase engagement and perhaps allow for two submissions – one at interim. An interim submission would encourage early reflection to increase opportunity for teamwork skills learning.

22: Attitudes Towards Future Teamwork: The reflective journal helped students see the value of their learning about teamwork, which we hope helps improves attitudes to teamwork for subsequent experiences. Attitudes might be further improved by finding a way of making reflection on the teamwork a team process – but this might be difficult in practice in an already overloaded unit. A number of students commented in the journals on the difficulties of working with students of different a cultural origin. SAPCA
evaluations also showed evidence of domestic student valuing contributions of international students less than they value the contributions of domestic students. This may reflect perceptions of lesser participation by international students not comfortable with contributing to discussions not in the mother tongue. While issues of cultural diversity in teams are discussed with students, it appears more work is needed in this area.

**RECOMMENDATIONS for students**

- Clearly differentiate between groupwork and teamwork so that everyone has a clear role that is essential for the team. This can be achieved via a regularly updated project plan that clearly schedules individual and team tasks.
- Seek help from teachers when conflict reaches a stage that is significantly affecting the team’s outputs and processes. But it is better to discuss and manage conflict early within the team.
- Reflect on team processes regularly – within your team and as an individual – so that you can identify how to improve and thus improve your teamwork skills. At the end of a team design project, reflect on which teamwork skills you have learned and which you can improve.

**RECOMMENDATIONS for teachers**

- The use Jig-sawing and Expert teams to differentiate teamwork and groupwork can encourage interdependency and reduce social-loafing. The use of expert teams should reoccur throughout the design process.
- Whilst it is important to provide students with the theoretical knowledge about teamwork (via lectures or written materials), students need to be directly engaged with this material via team learning (in, say, workshops) and through assessment.
- Conflict intervention can be important, but teachers need training in this difficult challenge.
- Reflective journals focusing on what students have learned about teamwork can increase teamwork skills learning and provide an artefact that can be used to assess teamwork skills.
- Issues around cultural diversity in teams require significant attention, especially when self-and-peer-assessment is used.

**RECOMMENDATIONS for curriculum designers**

- Ensure teamwork skills are taught and assessed at key moments in the curricula.

**RECOMMENDATIONS for accrediting bodies**

- Specify the teamwork skills that students should learn and seek evidence for this learning.

**RECOMMENDATIONS for practitioners**

- Provide continuous professional development opportunities for teamwork skills learning.
- Encourage team members to reflect in their teams on teamwork experiences and team effectiveness partway through a project and again at its conclusion. This will help improve team processes and ensure positive attitudes to future teamwork are fostered.
- Office managers may benefit from conflict management training – which may also be of use in situations outside of office teams.
ENVIRONMENTALLY SUSTAINABLE DESIGN 2, Case Study in Victoria University

**Learning Objective/s related to Teamwork Skills**

To present techniques for embedding team processes in their design projects

A principal aim of Environmentally Sustainable Design 2 is the formation of architectural engineering professionals who are able to assume simultaneously the habitus of engineers and architects. The underlying motivation of the subject is to liberate students and encourage them to apply their engineering skills in a highly creative and multidisciplinary environment. This is achieved, in part, by the unit being facilitated by a professional architect and an academic engineer. The students are provided with a brief, typically to design a beach house at a specified location, and the building must embody a number of features that improve its environmental sustainability. One of the first tasks the engineering students carry out is to gain aesthetic insights and inspiration from established designs available in the public domain. Simultaneously they are presented with some of the engineering principles that they may need to complete their projects. These are dealt with in more depth than may be encountered in similar courses. For example, the temperatures on the external surfaces of buildings are calculated using the gamut of heat transfer processes, and the resulting non-linear algebraic equations are solved numerically. Students also develop finely honed skills in applying three-dimensional modelling and rendering software. Team processes are taught and practiced by the students throughout the unit.

I. TASK LEVEL FACTORS

**SIGNIFICANT PEDAGOGIC INTERVENTION**

3. Task assessment: Environmentally Sustainable Design 2 was conducted by assigning students to design teams. The culmination of the student exercise was the production of a poster that featured 3-D renderings of the houses they designed, and the posters highlighted the environmentally sustainable interventions implemented in the designs. The posters were assessed as a team output. It was considered desirable to provide opportunities for the students to be assessed individually whilst still working in team settings. This was achieved by assessing individual students when they gave their presentations of the attributes of effective teamwork and their areas of expertise. Some tasks were assessed on a strictly individual basis by means of technical reports written by students and of an engineering skills audit. A small bonus mark was provided for students’ providing self and peer assessments. The summative assessments were complemented by formative assessments of students’ team working skills by means of one of the teachers meeting informally with the students throughout the semester. Issues addressed included the need to keep to a schedule, assessing how students were handling minor conflicts and feedback was provided to students.

II. INDIVIDUAL LEVEL FACTORS

**SIGNIFICANT PEDAGOGIC INTERVENTION**

4. Knowledge and skills: It is deemed desirable that team members have complementary skills that they can contribute to team projects. The rationale is to encourage a rhizomatic exchange of knowledge, *sensu* Deleuze. A pragmatic motivation for forming teams from members who have complementary skills is that the contributions of each team member are valorised, and they are recognised as being important to the success of the projects. The students were asked to write a few hundred words about their skills and interests before they were assigned to design teams. They did not have to confine their interests to academic subjects but they were encouraged to include the experience they may have gained as a result of pursuits such as hobbies or extramural employment. These might include skills associated with making scale models, project management in a work environment, managing a retail business, painting and drawing and so on. The students’ writings were collated, and they were used to guide the formation of teams comprising members with a diversity of skills and life experiences.
III. TEAM LEVEL FACTORS

SIGNIFICANT PEDAGOGIC INTERVENTION

9. Team composition: The student cohort in Victoria University is characterised by its cultural diversity. Hence, an intervention was made to distribute students from different cultural backgrounds evenly throughout the design teams with the intention of breaking down barriers and catalysing the benefits of diversity.

10. Team cohesion: It is hypothesised that teamwork is effective when each team member can make a contribution that is valued by other team members. As well as determining team members’ predilections before allocating them to teams, members from the design teams also formed teams of experts in the areas of:

- Climate analysis and design guidelines for green buildings
- Green design rating tools and software packages
- Site analysis, the Building Code of Australia and local building regulations as they related to the site of their proposed designs.

IV. TEACHING PRACTICES

SIGNIFICANT PEDAGOGIC INTERVENTION

12. Teaching teamwork: Providing students with an appreciation of the nature of teamwork was firmly embedded in the curriculum of Environmentally Sustainable Design. The students were set an assessed writing exercise at the start of the semester that required them to contemplate the advantages and possible pitfalls of teamwork. In addition each of the design teams was required to research in detail one of the following topics – Coordination, Communication, Idea Evaluation, Decision Making and Conflict Management Skills. Each team then presented their findings to the assembled class, and the students’ presentations were assessed individually.

13. Monitoring and feedback: An attempt was made to assess how students’ attitudes towards teamwork developed throughout the semester. This was achieved by conducting a total of three interviews of each design team – the interviews were carried out at the start of the semester, at the mid-point and at the end of the semester. The questions were open ended and the elicited the students’ attitudes and approaches to Coordination, Communication, Idea Evaluation, Decision Making and Conflict Management Skills. One of the class teachers conducted the formal interviews, and the other teacher informally monitored the effectiveness with which the students worked in teams.

OUTCOMES

3. Task assessment: The combination of assessments of team outputs and individual students’ efforts did not seem to detract from the quality and intensity of teamwork. One reason may have been that the theory and practice of teamwork pervaded the unit. The individually assessed skills audit and technical report provided a process for grading the students, a process inherent in the degree process. It is believed that continuous formative assessments and mentoring of teamwork processes by one of the teachers resulted in the students producing work of a very high standard.

4. Knowledge and skills: Tangible benefits of allocating students to teams based on their prior expertise appeared to improve the quality of the work produced by the students. For example, one student is a professional visual artist – a painter – and was able to bring this skill to bear on the design of the team’s poster. This student’s contribution was to produce high quality illustrative sketches of engineering principles that govern natural ventilation. The cohort of students included several mature-age people with industrial building experience. They were able to make use of this experience in specifying building elements such as windows. The teachers observed that the mature-age students were...
also able to provide a high level of organisational skills, social inclusion and very high ethical standards to the teamwork.

9. Team composition: The total cohort of students numbered 16, seven of whom were overseas students from the Middle East, and two were exchange students from Mexico and Germany. The local students were also from diverse backgrounds, as were the teachers who were both migrants to Australia - one hails from Europe and the other from the Middle East. Teams were formed not only on the basis of the skills of the students, but the students were selected based on their countries of origin to help them acculturate and ensure that English was the lingua franca of the teams. It was the teachers’ observation that this arrangement worked remarkably well, and difficulties such as social exclusion were avoided. As noted above, this may have arisen from the mature age students in the teams being socially sensitive. It may have been that the teachers also formed a multicultural team that is based on mutual respect.

10. Cohesion: Team composition and team cohesion are inextricably linked. It has been noted that the teams were formed to reap the benefits of the multiculturalism of the students. “Jig-sawing” was also implemented in which members of the design team were allocated to three expert teams that became knowledgeable on topics such as climate analysis, green design rating tools and design software and building regulations. Again, each member of each of the expert teams presented their findings to the entire cohort of students. Interviews with the students confirmed the effectiveness of the approach; although one response was that ‘it saves time’. Can that be interpreted as meaning ‘it saves effort’?

12. Teaching teamwork: The students were engaged with the ideas of teamwork by their writing a short essay on the topic in the first week. They were then encouraged to take a very proactive and creative approach to teamwork by each of them addressing Challenges 15 to 19 that relate to processes. This appeared to have a very beneficial effect as they immersed themselves in the topics. The students also had to work as a team so that they could present a coherent narrative to their fellow class members. This exercise also gave the lecturers an opportunity to provide students with advice on how to deliver oral presentations on their work.

13. Monitoring and feedback: The students’ attitudes to working teams were closely monitored throughout the unit by interviewing the design teams three times during the semester. The interviews focused on the five challenges discuss above, namely Coordination, Communication, Idea Evaluation, Decision Making and Conflict Management Skills. It is quite likely that this intervention resulted in a ‘Hawthorn’ effect in that students’ awareness of the benefits and possible difficulties of teamwork was heightened simply by participating in the interviews. The interviews were rather unstructured but it was noted that the students:

• Made use of modern technology – including setting up discussion groups.
• Seemed quite objective in recognising whom was proficient in what area.
• Recognised the importance of using diagrams and drawings when discussing ideas. This helps to depersonalize and objectify issues and it reduces the likelihood of conflict.
• Appreciated the technical mentoring provided by the teaching staff.
• Conflict appeared to be resolved before it got out of hand.

In the (admittedly subjective) opinion of the interviewer the students responded extremely well to being placed in culturally diverse teams, and as noted above this may be a reflection of societal trends and possibly by the fact that the teaching staff of the College of Engineering and Science are from a wide range of cultural backgrounds.
### RECOMMENDATIONS for students

- Be clear of the unique and specific contributions you can make to the success of your project. If the area of expertise you need is unfamiliar to you take the opportunity to learn something new.
- Be aware of the strengths of other members of your team, and encourage them to contribute.
- Become aware of team processes, and take an objective view of how they work. Take advantage of being a student to practice your teamwork skills in a supportive learning environment because this will hold you in good stead in your future endeavours.

### RECOMMENDATIONS for teachers

- Encourage students to become interdependent by forming expert teams and jig-sawing them with the design teams.
- Ensure that students become engaged with issues surrounding teamwork. This can be achieved by each design team researching a facet of teamwork and giving individually assessed presentations to the entire class.
- Teachers should be prepared to play mentoring roles in teamwork and technical issues. It is important that they create a supportive environment and make the students feel that they are members of a community of practice.
- University handbooks often state that students working in teams will carry out a number of tasks. The teaching staff must consider and implement teamwork rationally and explicitly. Conversely, they should avoid passively implementing team projects without considering the suggestions arising from this research project.
- Allocating students to teams to ensure cultural diversity appeared to work well. Teachers might also consider other factors such as attempting to establish a multicultural and effective teaching team, and to ensure that each design team has at least one student from the dominant culture who displays maturity and sensitivity.

### RECOMMENDATIONS for curriculum designers

- Establish assessment tasks that ensure the students display an appreciation of the nature of teamwork.
- Students must be provided with opportunities to develop their own skills that they can share with members of their team. This not only helps the formation of the students, but it may develop an esprit de corps.

### RECOMMENDATIONS for accrediting bodies

- Demand evidence that team projects are assessed in a manner that accounts for the efforts and skills of individuals.
- Accrediting bodies should be explicit in their requirements for students displaying teamwork skills, and their requirements would therefore appear in the curricula.

### RECOMMENDATIONS for practitioners

- Establish teams that comprise members with complementary skills.
- Use teamwork as a vehicle for mentoring junior and less experienced members of staff.
- Encourage individuals to develop towering expertise in areas that are relevant to the success of projects and the organisation.
- Provide sufficient resources for the team to accomplish its tasks.
- Install a leader who has a vision for the project and who can nurture the team members.
**DESIGN STUDIO 4, Case Study in University of Tasmania**

**Learning Objective/s related to Teamwork Skills**
Demonstrate the ability to make useful contributions to collaborative design project as an engaged team member and reflect on these experiences.

The unit focuses on the climatic design of medium scale building, and its impact on the program, form and construction. This is achieved by the same building brief being designed on two sites with different climatic settings. The first design scheme is undertaken in teams, promoting greater discussion of key issues and choices, and learning. Teamwork skills are taught, including positive and negatives roles, decision-making processes and reflecting on how to engage team members in the process. The second design scheme is carried out individually, drawing from earlier experiences with the brief and ways to consider the problem. The design of the medium scale building is extended by work in KDA223 Building in Technology in Design 4.

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**I. TASK CHARACTERISTICS**

**SIGNIFICANT PEDAGOGIC INTERVENTION**

3. **Task Assessment:** Revised the assessment method to better reflect individual contributions to the team design process and product. Each student received a personalised result that included the overall grade for the design product multiplied by a contribution factor (between 0.5 to 1.5) and a grade for their personal reflection on the collaborative design process and teamwork. The contribution factor reflected the weekly self-and-peer-assessment (SAPA) averaged over the course of the teamwork task. A weekly employment of the SAPA identified teams requiring assistance in team dynamics, as well as informing students on their progress and contribution to the team.

**III. TEAM LEVEL FACTORS**

**SIGNIFICANT PEDAGOGIC INTERVENTION**

8. **Team Contract & Climate:** At the start of the teamwork design task, teams were asked to discuss their agreed management process, rules of engagement and communication, decision-making process and dispute resolution, and document these as a Team Contract. A proportion of students perceived this process to be excessive for a 4 week task and joked about its level of appropriateness; these students were more focused on the design task than the dynamics of teamwork. Prior to the start of the teamwork design project, students had spent two weeks speed dating each other and part of this process explored issues of positive and negative experiences in past team and group assignments. They also discussed decision-making processes and ways to deal with conflict. These workshops were supported by literature presented in the class lectures and examples of current design practices.

9. **Team Composition:** Teams were required to be culturally diverse. The team composition required two ‘local’ students and two students from ‘overseas’. The student cohort was roughly even with 50 local students and 50 overseas students. Previous attempts to encourage team diversity were limited in success.
IV. TEACHING PRACTICES AND SUPPORT STRUCTURE

SIGNIFICANT PEDAGOGIC INTERVENTION

11. Team Formation: Teams of 4 students were formed by a self-selection process and informed by speed dating workshops. The only stipulated requirement was 50% of the team were local students and 50% of the team were from ‘overseas’. This criterion was important for a number of reasons. Firstly, it supported the articulation of 20 new overseas students into the unit and the cohort. Secondly, there are limited strategies within the School for overseas and local students to mix. Thirdly, it generally ensured that team membership was not based entirely on friendships, which would limit the potential for teamwork learning and strategies. One team was formed outside of these rules due to their distance living away from the university campus.

VI. TEAM OUTPUTS

SIGNIFICANT PEDAGOGIC INTERVENTION

20. Quality of Team Product: The structure of assessment task and assessment process supported a team-based approach. Three-quarters of the assessment was based on the Team Product. This was then individualised by averaging the SAPA results for each team member and using this as a multiplier to the Team Product. There was no advantage gained by individuals attempting to identify individual contributions. The only component that required an individual approach was the personal reflection on the team and design process.

OUTCOMES

3. Task Assessment: The employment of the averaged SAPA as a multiplier to the Team Product was, in most instances, reflective of the team dynamics and processes observed. Students appeared to be in favour of the SAPA process as a method to capture individuals’ contributions to the teamwork. A few commented that they were happy that there was some mechanism, if teamwork went awry, to reflect these circumstances. There were at least 2 out of the 25 teams that were experiencing difficulties in team dynamics, however the SAPA did not reflect this. A couple of students were reluctant to evaluate their peers’ limited contributions, as they did not want to cause offense. These examples emerged from local and overseas students. From a teaching perspective, the regular SAPA process reinforced students to think about both their contributions and the success of the teamwork. It also confirmed or identified difficulties being witnessed by the tutors and informed their approaches to certain teams.

8. Team Contract & Climate: A significant proportion of students appeared to think that the formation of a team contract was excessive, and playfully questioned its usefulness. To improve students’ perception of the role of the team contract, the tutors will need to be better equipped to engage teams in why this is relevant and, further, to reinforce and refer back to the team’s contract when assisting teams to monitor their progress, delegate tasks and make collaborative design decisions. Overall students appeared to engage with the spirit of the team based design project.

9. Team Composition: From a teaching position the requirement for teams to be culturally diverse was successful, in that it supported the articulation of the 20 new overseas students into the Design Studio and the cohort. The majority of students saw opportunities presented by this requirement, or were at least open to this experience. In the future, the process may be further supported by sharing past students’ reflections and experiences on the experience, highlighting the perspectives and challenges faced by culturally diverse teams. This strategy for team composition would be employed again, as it appears there are very few opportunities like this presented in their course. The diversity of the team members means that the emphasis on developing teamwork skills and processes has a greater relevance than that presented by a team of friends or members from the same culture.
There were 3 out of 25 teams greatly challenged by the composition of their team. In one team the composition involved two local men who were mature aged students with two women from overseas. With hindsight, and being able to review their final grades at the end of the unit, it was apparent that the skill level of these students was also diverse. The men were working at a distinction level whereas the women were working at a low pass level. There was no observable conflict, but a split in roles. Another example of a team that experienced difficulties was one composed of three local students and one international student who had recently arrived. This was the only team that was lopsided in its composition. In the future the one overseas student would be negotiated into another team, even if this meant 5 in the team. To the credit of the international student they persisted and worked at communicating with the team and engaging more in the team process.

11. Team Formation: The persistence of the teaching team to allow students to self-select their team members was augmented by the requirement of culturally diverse membership. This ensured diversity and the potential need for the team to form rules and a contract to work. The process of students getting to know more of their peers and the ways that teams were established would be strengthened further by ‘profiles’, or by students articulating their own approach and skills. The alternative position of teams being formed by the lecturer has been resisted. However, where students commuted a great distance to the campus, the lecturer was involved in negotiating and suggesting team memberships.

20. Quality of Team Product: The structure and assessment of teamwork based design project ensured the majority of work was a product of teamwork. Overall the quality of work was at a good or excellent standard, which reflected the success of the teams engaging in the process. Where teams experienced challenges in their dynamics the work was at a lesser standard than if members had worked individually on the project. This trend was found by comparing the students’ performance in the team based design project with their later individually designed project. Overall the employment of the SAPA multiplier reflected the individuals’ capacity well as the majority of these results correlated with their individual design projects later in the semester. Out of the 100 students there were only 3 instances identified where these results diverged significantly.

RECOMMENDATIONS for students

- Be prepared to communicate to a greater level about design and team based processes and be more self-aware of the level of contributions made to ensure everyone participates.
- Be aware that the past results indicate that where team dynamics work well the product quality is generally at a good and, sometimes, an excellent standard. Whereas disharmony generally means a compromised result and product.
- Be open to what different team members can bring or contribute, looking for people’s strengths as well as using the opportunity to become more aware of the designing process and what it means personally and to others.
- Frame this experience as practice and knowledge building for the later individual project, but at the same time developing teamwork and interpersonal skills.

RECOMMENDATIONS for teachers

- There needs to be a mechanism to capture the team dynamics and members’ contribution that regularly informs the students and teachers, as well as being meaningful in assessment. For this case study, the SAPA improved students’ confidence in the teamwork based assignment and marking process. It also allowed for students to respond to concerns raised by other team members’ peer assessments. It is by no means perfect but is a great improvement when compared to no mechanism being employed. The SAPA needs to be at regular intervals to provide a more consistent overview of team dynamics and for students to become familiar with the process.
• There needs to be consistent monitoring and support to teams in how to work together and arrive at decisions.
• Ensure that the teams of tutors are engaged with the purpose of the task and can suggest other options or strategies when a block occurs.
• Body language provides an accurate indication of the team dynamics. Photographs taken during studio correlate with the level of communication and teamwork occurring.
**DESIGN COLLABORATION**, Case Study in The University of Newcastle

**Learning Objective/s related to Teamwork Skills**
During this course students will be involved in: (1) Project initiation processes; (2) Developing collaborative design capacities; (3) Providing design process management strategies; (4) Applying effective design documentation processes to recording of design processes; and (5) Experimentation with a range of materials, processes and techniques, which contributes towards a student defined project.

This course integrates advanced workshop skills with design process in the context of Design and Technology through teamwork and self-directed projects. The course will offer an opportunity to learn various workshop related skills and responsibilities through a range of processes and materials. The design projects will assess individual and collaborative design capacities, detail project management skills and document the progress through the design process.

Workshop safety and appropriate working practices will be emphasised as a means of creating work of quality in a productive and safe environment.

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**III. TEAM LEVEL FACTORS**

**SIGNIFICANT PEDAGOGIC INTERVENTION**

9. Ensure diversity in teams with regards to gender, culture and past experience through team formation methods: The class has a very mixed cohort with the majority of students choosing the course as an elective. The cohort consists of large numbers of international students and has students from multiple disciplines undertaking it, including Architecture, Construction Management, Engineering, Industrial Design and Design and Technology students. When forming teams the coordinator ensures that each team’s constitution, usually 4, is representative of the diversity of nationality and disciplines in the overall class, therefore the teams are instructor formed rather than self select.

**IV. TEACHING PRACTICES AND SUPPORT STRUCTURE**

**SIGNIFICANT PEDAGOGIC INTERVENTION**

11. For culturally diverse teams, try not to isolate single members of a culture different from the rest of their teammates: The class has a high representation of international students and it is therefore important to spread them around in the groups to ensure that they do not group together. It is important that students experience collaborating with students from different cultures.

12: Teach student teamwork skills: (1) Generic teamwork skills; and (2) Collaborative design skills: The students are provided with lectures which outline the strategies which support effective collaboration and the role that it has in industry. The students engage in discussion of the issues and are provided with a structure that both encourages and supports collaboration. This structure is built into the reporting and assessment structures.
13. Process Feedback on Teamwork: Students are involved in peer review during the project. The peer review information is collated by teacher and returned to the student in the form of formative feedback. Discussions are held with individual students if there are issues identified through the process of peer review.

V. TEAM PROCESS

SIGNIFICANT PEDAGOGIC INTERVENTION

16. Communication: Students are involved in using an online Log as their primary means of documentation. The LMS provides a forum for online interaction that extends the potential for collaboration to outside the formal class time. It provides virtual discussion and bulletin boards for the team to sustain active collaboration outside of formal meeting times.

VI. TEAM OUTPUTS

SIGNIFICANT PEDAGOGIC INTERVENTION

21: Learning of Teamwork Skills: Students receive ongoing feedback on their participation and collaboration. The use of the online environment allows instructor to monitor team activity and intercede when issues arise rather than wait till end of project’s Summative assessment process.

OUTCOMES

9. Ensure diversity in teams with regards to gender, culture and past experience through team formation methods: Student focus groups identified this as one of the positive aspects of the project. Students identified that the experience of working with students from other disciplines was a great benefit as it showed that there were multiple ways of doing things as well as the opportunity to take on new skills demonstrated by students from other disciplines.

11. For culturally diverse teams, try not to isolate single members of a culture different from the rest of their teammates: Both International and domestic students thought the opportunity to work with students from other cultures so “intimately” was a great experience in the long term as it made them rethink their communication strategies and although difficult at times work through language communication issues. Students did identify it was difficult at first but it did work to a good outcome and broadened their horizons for collaboration.

12: Teach student teamwork skills: (1) Generic teamwork skills; and (2) Collaborative design skills: The students identified the lectures were very positive and did remove many of the operational difficulties in collaboration. There was a request for more conflict management skills and group decision-making strategies to be included.

13. Process Feedback on Teamwork: The peer review process used predominantly as a formative assessment process allowed students to receive feedback during the design build process. Students appreciated this but still identified that subjectivity could become an issue using this method but did articulate that they saw the assessment structure removed this bias when marks were involved.

16. Communication: Students appreciated the ability to continue collaboration in a virtual form during meetings. They also liked the ability to upload logs at weekly intervals knowing that these were monitored and used to prompt intervention where necessary.

21: Learning of Teamwork Skills: Students were most supportive of the opportunity to learn team-working skills. The assessment strategy employed provided them with the
confidence that their individual effort would be acknowledged in their final mark for the assessment. Once the issue of assessment was resolved it was the collaboration and teamwork that the students focussed on.

**RECOMMENDATIONS for students**

- Encourage full use of the online environment for ongoing collaboration outside formal class time.
- Students need further training in achieving shared understanding.
- Students need better-defined strategies for conflict management skills.

**RECOMMENDATIONS for teachers**

- The need to develop a statistically valid way of allowing students to gain a higher mark than the project mark. The current mode provides for differentiation within the range of the project score but limits the best students to the project score. A means of developing a statistically sound way of doing this through the development of an algorithm is needed.

**RECOMMENDATIONS for curriculum designers**

- Encourage student communication skills in other subjects that then allows for better communication in group-work experiences. Graphic or sketching skills are important in achieving shared understanding of design concepts.

**RECOMMENDATIONS for accrediting bodies**

- Specify the teamwork skills that students should learn and seek evidence for this learning.

**RECOMMENDATIONS for practitioners**

- CPD or CPE should provide for opportunities for teamwork skills Development. Development of frameworks that fairly evaluate performance in teams.
Appendix H: Report of the Independent Evaluation of the Project
1. Executive summary

The hallmarks of a successful project are that it meets a demonstrated need and that, through effective project leadership and management, it achieves its intended outcomes with a high probability that the project will, indeed, make a significant contribution to student learning in its specified context. The independent evaluation of this project indicates that these criteria were substantively met and the sector stands to gain from a well conceptualised and largely well executed study. As a member of the project with substantive experience in similar projects claimed:

The project has developed an excellent background study of this topic, informed by current practice and a good strategy to support the selective adoption of its findings. Coming from a very low knowledge base in these disciplines, the findings are extremely useful.

There is compelling evidence that this project, through its framework, manuals and recommendations, case studies and website, supported by scholarly publications, should enhance team and group learning in design.

The grant proposal as well as the interim and final reports offer convincing arguments and evidence of the need to incorporate team and group learning into design disciplines. As claimed at the outset of the grant proposal, architects must be able to design as part of a team, yet this essential professional competency is largely neglected. The inclusion of the Chair of the National Education Committee of the Australian Institute of Architects, who is also the President of the Australian Deans of the Built Environment and Design on the reference group, should do much to ensure that the findings of this project inform and influence approaches to accreditation and hence curriculum approaches to teamwork.

As he wrote:

The project is very timely as the profession and the architecture discipline in Australia (and the world) move towards a greater degree of inter-disciplinarity, diversity of student cohorts, and the changing nature of work practices including relationships with sub-consultants, para-professionals and non-design professionals within architectural procurement processes. The globalisation of the profession means that there is a need for students and graduates to be able to understand that design arriving from a singular vision has well and truly disappeared, and that working in teams and in collaboration entail a diverse range of approaches and practices, including mediation by the ever changing digital technology platforms.

At the more specific level, there is currently an unprecedented level of on-going changes to the higher education in Australia, at a policy and audit level, as well as in the accreditation of architectural education. As TEQSA processes come on-line, the Threshold Learning Outcomes (TLO) for the discipline of architecture will be put into action, and there is a great opportunity for the teamwork learning and assessment project to provide nuanced and workable criteria for teamwork to be assessed and reported for audit. ADBED holds the custodianship of the TLO.
A similar situation exists with the current review of the National Competency Standards in Architecture (NCSA) by the Architectural Accreditation Council of Australia (AACA), and the National Education Policy and Framework by the Australian Institute of Architects. This teamwork project has a key opportunity at this moment to influence the criteria for the accreditation of architecture programs in relation to evaluating teamwork teaching and assessment. There is a specific need for conceptualising teamwork for online teaching of design (Personal communication, Loo, January 2014).

Hence this project has the potential to change national practices and policy. Through the participation of an international scholar in the reference group, involvement with 6 Canadian universities as well as through global access to the scholarship and materials developed, there is also the likelihood that it will have an international impact, as already indicated by requests to use the manuals developed as part of this project from Canadian and American design schools.

Four universities (Deakin University, University of Newcastle, the University of Tasmania and Victoria University) collaborated on this project, and an important positive outcome for this project was the increased understanding of all the project participants. It is encouraging that team members felt the project provoked them, and their students, to consider the implications of working in teams leading to better teaching and learning outcomes. Each project team member already had a demonstrated interest in, and commitment to, teamwork and it is salutary that comments such as “I am now painfully aware of how poorly my colleagues and I approach teamwork” and “I have a far greater understanding of the issues around team work in design and improved teamwork skills” were made. It is a strength of projects such as these that participants are able to reflect critically on their practice, as well as those of others. A further positive outcome for the project is that instances of its impact in the immediate future on their teaching – and that of their colleagues – were cited.

Those interested in using group and team learning (especially in Architecture and related design contexts) should find much of value regarding the pedagogical value-adding of teaching this way and the materials developed should be of considerable assistance to all stakeholders. Probably the true test of the success of this project will be twofold:

- The degree of influence it has on the criteria for the accreditation of Architecture programs in particular in relation to evaluating teamwork teaching and assessment and hence its impact on curricula
- The extent to which the materials developed by this project are used and then have a positive impact on student learning within the next few years.

2. Evaluation and the role of the independent evaluation auditor

The grant proposal (p7) stated the project evaluation would determine:

- The extent to which the project has achieved its stated outcomes
- Strengths and challenges of the project management process
- The utility of the deliverables for the relevant stakeholders
- The success of the dissemination strategies

It was agreed at the outset that the independent evaluation would consist of an interim evaluation completed in December 2012 (see Appendix 2 for the report) and a final evaluation undertaken from November 2013 to January 2014. It was also agreed that the role of the independent evaluator was to evaluate the project, itself, appraising the processes set in place to achieve its stated outcomes and determining whether the project was implemented as planned. It is beyond the scope and timeframe of this evaluation to draw conclusions regarding the utility of the deliverables and the success of the dissemination strategies beyond seeking informed perceptions from the project team members and reference group. While these perceptions and the findings reported are useful, it will
take 2-3 years, at a minimum, and then quite rigorous research, to gauge the utility of the deliverables for all relevant stakeholders (defined in the Final Report p25 as curriculum leaders, teachers, students, employers and the professional body) and to determine the success of the various dissemination strategies that have already been implemented and those that are proposed.

From the experience of the independent evaluator with similar projects, salient elements that contribute to the success of projects such as these are:

- Effective project leadership and strong project management
- Sustained effective partner contributions supported by adequate institutional support
- Shared understanding of the project’s desired outcomes and what is needed to achieve these
- Appropriate guidance from the reference group

Leading to
- Useful deliverables and the meeting of the project’s stated outcomes

Supported by
- Effective dissemination strategy(ies)

Each of these is considered below.

To determine the extent to which each of the indicators of success was achieved the independent evaluator:

- Reviewed the documentation related to the project.
- Attended the final workshop in November 2013 and had informal discussions with members of the project team except one who was absent and facilitated a focus group discussion with 3 members of the reference group.
- Prepared, administered surveys and analysed surveys (see Appendix 1). The 3 members of the reference group who attended the workshop (one is in the UK) completed Part A then all 4 completed Part B in January 2014. The 6 members of the project team completed their surveys in January 2014.
- Had follow-up email and telephone discussion with members of the project team and reference group.
- Interviewed the project leader twice (before and after the data gathering process) and the project manager once as close to the completion of the project as was feasible.

The evaluation brief did not include contact with academic teaching staff outside of the partner group, students, or members of the relevant professional body and employers. Given the budget and timing, these constraints are reasonable but, as noted above, this precludes the kind of evaluation that does assess value and impact of the project’s outcomes for all stakeholders.

It should also be noted that, following the analysis of the survey responses and the circulation of a draft independent evaluation report to project team members in mid-January 2014, perceived gaps that had been identified were addressed. The extension permitted to the submission of the Final Report allowed sufficient time for this to occur and the willingness of the project leader and team to respond to criticism ensured all the intended outcomes were met to a high standard.
3. Indicators of success

3.1 Effective project leadership and strong project management

<table>
<thead>
<tr>
<th>N=9</th>
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<th>Extent</th>
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<th>1 Very low</th>
<th>2 Small</th>
<th>3 Reasonable</th>
<th>4 Good</th>
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<tr>
<td></td>
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<td></td>
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<td>Project manager</td>
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<td></td>
<td>Self-rating</td>
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<tr>
<td>NOTE*: Definitely for 1, and probably for 2 respondents, the rating was attributed to the work of the project leader.</td>
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</table>

Described by one member of the reference group as “an exceptionally able and conscientious academic”, members of the project team were unanimous in their acknowledgement of the passion and commitment the leader brought to this project. Those who provided a ‘5’/‘very good rating’ (one-third of the respondents), did so on the basis of “outstanding academic leadership” – his scholarly approach and the ability to provide the project with strong leadership and clear direction. His enthusiasm led to a significant, sustained contribution as he drove this project, but those who provided lower ratings pointed to his tendency to take too much on himself, so curtailing their level of contribution. One of the partners believed the project could have been improved if the participants had more interaction with the project leadership team so their approaches may have been better informed by scholarship.

As noted in the Interim Evaluation Report (see Appendix 2) both the project leader and project manager were inexperienced. Lack of understanding of the requirements of the important role of project manager did cause problems, especially in the first year of the project. Project participants expressed concerns regarding lack of forward planning in some stages of the project and elements such as incomplete knowledge of procedural requirements were also noted. Attendance at the OLT workshop some months into the project greatly increased understanding of what was involved, and the interim independent evaluation made several recommendations (see Appendix 2) that had a positive impact on the management of the next stages of the project.

Both leader and manager valued the work of the other with ratings of ‘4’/‘good’ and ‘5’/‘very good supported by comments and illustrations of effective teamwork. It is always helpful when the project leader and manager can work closely together - as was definitely the case for this project - and some merging and overlapping of roles is not only probable but can be productive. Between them the project manager and leader ensured that progress was documented each quarter and processes were put in place to complete agreed deliverables within specified timeframes. However, estimations by both project leader and manager that the project leader did around 35% of the project management, plus team comments such as “I always got the impression that the project leader was acting as the project manager”, point to some deficits in this regard. Further, the conflation of the roles of research fellow and project manager, which was based on advice from other grant recipients and on personnel availability, may have ensured “comprehensive knowledge and understanding of all project processes” (Final Report, p48), but the project leader conceded some difficulties arose as a consequence. Although the split was notionally 50/50 there are several Indications that the project manager privileged her role as research fellow.

Despite these reservations, because there is no question of the commitment of both leader and manager to this project and because there is evidence that management of the project was considerably stronger in the second year, working closely together the project leader and manager achieved what was required to bring the project to successful fruition.
3.2 Sustained effective partner contributions supported by adequate institutional support

<table>
<thead>
<tr>
<th>Extent</th>
<th>Partner contributions</th>
<th>Institutional support</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=9</td>
<td>0 1 2 3 4</td>
<td>0 1 3 3</td>
</tr>
</tbody>
</table>

The grant proposal (p7) specified the role of each of the 4 partner institutions. Deakin, as lead institution, was responsible for project design and leadership/management (see above). The project leader concluded this meant Deakin also provided strategic oversight and goal-setting (rather than Newcastle) but staff from there claimed their past experience was used to provide direction and support to assist the project to clarify and achieve its goals. Tasmania University met its commitment to local development with one trial/case study but their team member was aware that there were constraints that precluded involvement with the ‘bigger picture’ and unforeseen circumstances limited participated in the later stages. Victoria University also met its responsibility for local developments and trials but their contribution in the multi-cultural domain was not as strong as envisaged and the project team are aware this aspect needs further attention.

As well as honouring their project commitments in terms of ‘in-kind’ time contributions in addition to time-release specified in the budget, a culture that supports endeavours such as these contributes to successful outcomes. All felt that Deakin, the lead institution, had been strongly supportive, most especially at the local School level. The situation within the partner institutions was not as clear cut to the extent that some partners felt unable to rate or comment on the degree of institutional support for the project. Where partners feel their institution is not supportive or interested and/or partners deliberately work independently and choose to isolate themselves, wider, more systemic change during the project is improbable, as seems the case here. However, awareness of this, coupled with a desire to publicise activities and promote the findings and results of the project more widely within at least some of the partner institutions, should mean that partner institutions maintain their involvement and increase the project’s value in their domains.

The project reinforces the often reported conclusion that much of the success of such activities depends on the attributes of the project team - those who will formulate and then lead the project and those who will implement the proposal. For any such project to succeed, it is vital that the members of the project team are keen to participate and that the team has the appropriate mix of skills, expertise and experience. This project has a leader who is recognised at institutional and national/international level for excellence in teaching and for his scholarly approach to pedagogical research. As well as a commitment to team learning, he brought substantial experience to the project. All members of the team have impressive credentials in terms of this project (see grant proposal, Appendix 5) and were in a strong position to make a valuable contribution. The project leader considered his ‘prime’ task was to assemble an effective team and he judged success in this regard at ‘5’/‘very good’.

The 5 project partners were asked to assess their level of contribution, with most assessing it as ‘4’/‘good’: see Table 2.1.
Table 2.1  Self-assessment of individual partner contributions

<table>
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<tr>
<th>Extent</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner contributions</td>
<td>1</td>
<td></td>
<td>1</td>
<td>3</td>
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</tr>
</tbody>
</table>

They could point to specific contributions mainly concerning their local trials and case studies as well as their active participation in discussions through project workshops and the symposia. While the bulk of the documentation and scholarly writing came from the project leader and research fellow, there appears to have been active, sustained involvement by the partners.

Project partners were asked to state what – if anything – they gained from contributing to the project. All referred to increased understanding and skills with the following two comments indicating the project’s value not only in personal growth and satisfaction but also its perceived broader impact:

Simply by participating in the project we have gained so much. Firstly, our interventions provoked students to consider the implications of working in teams, and we believe that this resulted in our students producing (even) better work. … Academics’ facilitating students’ teamwork provides them with an opportunity to mentor them in acceptable methods of presenting their work. Ideally, it provides an opportunity for staff and students to operate as a community of scholars – something sadly lacking in many universities. I am now painfully aware how poorly my colleagues and I approach teamwork. Little thought is given to any of the questions raised by the OLT project.

After two years of working on the project I am in a much better position to understand the national situation, as regards teaching teamwork in design. I am also aware of many new approaches to the topic that I can now pass on to others ... to help them to improve the situation for students and staff. I also think that I have now met the whole group of national zealots/enthusiasts – who have supported this issue despite strong apathy and disinterest from their colleagues – and they now have a sense of belonging (or at least less isolation) which is very valuable for the future. It has been great to be part of a project that I am not leading and enjoy seeing other people grow in their skills and achievements and support a cross disciplinary, national (and indeed international) initiative. It has been a rewarding experience.

The achievement of the case studies and the materials developed, the unanimity of opinion that this is a valuable and rewarding project and the high probability of future teamwork in this area are all telling indicators that the partnership was productive.

3.3  Shared understanding of the project’s desired outcomes and what is needed to achieve these

It is vital that those who are working to implement the proposal have a full understanding of what the project is about and where it is headed. Feedback from members of the project team indicated this was not always the case. As late as the final workshop there was debate about what constituted ‘design’ and how ‘group’ and ‘team’ learning were differentiated. Team members who sought opportunities to interrogate critically the need for group and team work, or who sought to explore why such an approach should be privileged, expressed frustration that would probably have been obviated if surfaced and discussed at the outset of the project. In response to comments such as:

I think that the project has definitely developed a proposal to improve teamwork skills as part of a larger curriculum. In a narrow sense, this fulfils the stated goal. But I don’t think it has made a case for such a renewal (which wasn’t a stated goal, but is probably the practical precursor to achieving its outcome). The core problem is that the project never really set out to gather the right data to
convince someone to adopt these methods. Instead it set out to develop data to support improvements. I suppose that is OK, but strategically less ideal.

the project leader was adamant that such considerations were beyond the scope of this project with ‘enhancement’ (ie supporting improvements) of group and team work being the crux of the grant proposal. He concurred that it would have been productive spending more time at the outset to ensure there was a shared understanding and that revisiting the grant application at key stages with explicit linkages of activities to what was proposed is necessary.

With a project concerned with teamwork, the project leader was aware of the need to adopt a consultative approach. Monthly team meetings and regular circulation of materials and participants were put in place to keep members involved and informed. Partner involvement in the workshops in year 2 (a recommendation of the interim evaluation: see Appendix 2) was especially beneficial in assisting team members to have confidence they understood what was required and provided opportunities for their input – and also that of the reference group.

Despite these endeavours, feedback from both the project leader and other members of the project team indicate that the project was run very much by Deakin and the partner institutions tended to work independently and autonomously responding to direction and requests. However, within this construct, the project team produced case studies that, while restricted to these 4 universities, are diverse and clearly embedded in authentic practice and which contributed to the key documents: the framework, manuals and recommendations.

3.4 Appropriate guidance from the reference group

<table>
<thead>
<tr>
<th>Extent</th>
<th>No response</th>
<th>0 None</th>
<th>1 Very low</th>
<th>2 Small</th>
<th>3 Reasonable</th>
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<th>5 Very good</th>
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<td>2</td>
<td>1</td>
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</table>

The stated role of the Reference Group (Grant, p9) was to (a) provide advice and input into the project activities (b) act as a sounding board for the project leadership team and (c) participate in network activities. Reference groups do much to ensure the achievement of high quality outcomes and it is essential to appoint appropriate/useful people who have the time and energy to contribute and for the project leader, especially, to understand how to use their expertise to maximise their input.

In this project, while the proposed number of 5 was reduced to 4, the area they were intended to cover (ALTC discipline scholar) was largely met by a member of the project team with significant ALTC experience and the ALTC experience of the representative from what was then Deakin’s Teaching and Learning institute. The group was strengthened by having both a local faculty-based discipline leader and an international expert in this area. As noted above, the inclusion of the Chair of key national committees should do much to ensure that the findings of this project inform and influence approaches accreditation and hence curriculum approaches to teamwork.

Project members expressed their appreciation of the ‘very telling and invaluable’ contribution of the ‘very supportive’ reference group – “The reference group gave the impression of being highly experienced, and it was a pleasure to work with them”. Members of both the project team and reference group expressed concern that this resource was not fully utilised and the project leader acknowledged that his inexperience caused him not to make best use of their expertise. However, and especially towards the end of the project, each made telling contributions. While there was
some blurring of project team and reference group roles, as in the final workshop which the independent evaluator attended, this was done ‘in a positive and collegial manner’.

As is nearly always the case, factors such as busy work schedules and distance militated against a consistent level of involvement but each could document strategic and useful contributions at various stages through the life of the project. While they felt the reference group had provided appropriate guidance, as did the project team partners, (see Table 3), mainly because of competing commitments that precluded ongoing involvement most rated their individual contributions at ‘2’/’small’ or ‘3’/’reasonable’ with one at ‘4’/’good’. While giving their time and expertise to the project, members of the reference group also felt they had gained from their participation. They, too, had increased their awareness and knowledge in this area – “I’ve gained a much, much better appreciation of the efforts required for properly treating teamwork in pedagogical circumstances” - and there was evidence of transference to their contexts as with “I will surely transfer some of the outputs of the project in my own academic practice to [my university] and also inform currently ongoing pedagogical research”.

4. Outcomes

<table>
<thead>
<tr>
<th>Table 4 Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N=10</strong></td>
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<tr>
<td>No/uncertain response</td>
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<tr>
<td>Investigation of how best to support the learning of teamwork skills through teaching and assessment</td>
</tr>
<tr>
<td>Provision of curriculum renewal proposals to include a structured framework for teaching teamwork skills with an associated suite of assessment tools</td>
</tr>
<tr>
<td>Development and documentation of best-practice models of assessing individual contributions to teamwork</td>
</tr>
</tbody>
</table>

The grant proposal (p1) stated that the project had 3 stated outcomes and each of these is considered separately. As Table 4 indicates, project participants considered the outcomes have been met, most judging this to a ‘4’/’good’ and ‘5’/’very good’ extent.

4.1 Investigation of how best to support the learning of teamwork skills through teaching and assessment

An experienced member of the project’s reference group considered there was “a thoroughly scholarly and evidence-driven approach to the topic – could not fault it” and his views were supported by another reference group member who regarded the depth of investigation as commendable. The project leader, himself, considered the investigation to be “as thorough and complete as I could have hoped for”. However, as one of the team members acknowledged in relation to their own research, empirical findings were obtained is a less rigorous way with “rather unstructured classroom or design studio trials”.

As proposed in the grant proposal and described in the Final Report, the project was structured to progress from a survey of existing practice to the testing of this practice leading to a delineation of
what constitutes ‘good practice’. Of special value is the richness of the investigative process which incorporated a comprehensive literature review, surveys, focus groups, workshops and symposia. That 638 students and 68 teachers in total completed the surveys helps balance the small number of trials and case studies undertaken by the partners in the 4 institutions. The project team acknowledges (see Final Report pp62-63) that the preponderance of responses come from the 4 partner institutions with 35% of the 417 who completed the national survey coming from Deakin University but it is pleasing to note that students from 18 universities participated. The Report also notes (p35) the challenge of having adequate student and teacher numbers for meaningful statistical analysis. The decision to abandon student focus group discussions was sensible as it was time- and cost-inefficient and online surveys generated useful quantitative and qualitative data.

Although some reservations about the sequence of data collection and analysis leading to recommendations were expressed, in this highly iterative research design initial experience and findings informed later cycles of the research. For instance, the validity of the Framework of Effectiveness in Student Design Teams was tested through national teacher and student surveys with those data leading to the articulation of 22 factors of relevance to stakeholders and then those factors being refined through case studies, focus groups and workshops.

4.2 Provision of curriculum renewal proposals to include a structured framework for teaching teamwork skills with an associated suite of assessment tools

Most members of the project team and reference group considered this outcome had been met and to a ‘good’ extent (see Table 4 above). There is agreement that the project developed proposals to improve teamwork skills through the detailed guidelines expressed in the Framework of Effectiveness in Student Design Teams and supported by the separate manuals on teamwork for teacher and students and the suite of recommendations that are usefully configured to be applicable to each stakeholder cohort. The framework, itself, has been judged favourably with one member of the reference group seeing it as “an original, useful and extremely valuable output of the project”.

There are reservations, however, regarding how this can directly translate into effective strategies for curriculum development. For these to flow to curriculum change it is important to provide compelling well-supported arguments to those with key roles and, for this reason, it is pleasing to note specific detailed recommendations for the professional accrediting bodies and teaching and learning leaders within institutions.

Project team members recognise that, within an already crowded curriculum and with a perception that teamwork is resource intensive, it is imperative to provide a framework that is not overly complex to administer and so unwieldy in practice, one that is meaningful to a broader audience than those already convinced of the value of group and team work. Whether they have achieved this aim will not be known until the framework, manuals and recommendations reach a wider audience, are put into practice and evaluated.

4.3 Development and documentation of best-practice models of assessing individual contributions to teamwork

Indicative of a lack of shared understanding in some salient areas (see 3.3), the comments from some of those who rated this aspect highly (see Table 4 above) revealed that they did not appreciate that this outcome specifically dealt with assessing individual contributions to teamwork. The ‘2’/‘low extent’ came from a team member who felt the project provided ‘little explicit guidance’ in this area and this is an aspect that was specifically addressed towards the end of the project.
Given this project concerns ‘enhancing and assessing group and team learning’, and that “assessment was also identified in the national survey as the pedagogical factor that students thought was the most important for teachers to get right” (Final Report, p35), it is important that assessment receives the attention it merits. The call for case studies of best/innovative practices in teaching and assessing teamwork though the second National Teaching Symposium points to a recognition of a deficit in this area. Data from the study were used to inform a specific module (4) in the Manual on Teamwork for Teachers and this offers useful guidelines to address such core concerns as balancing individual and group assessment. Guidance in this area will also be provided through papers in the scholarly journals (4 related to assessment of teamwork have been published or submitted for publication during the life of the project) and the envisaged book. One member of the reference group considers the project leader’s work to be “the best practice [assessment] benchmark in Australia” and his approach in this regard is documented in the Deakin case study.

Assessing teamwork was also addressed at a workshop he led which was held as part of the internal Deakin Learning conference and the provision of similar workshops elsewhere should be of benefit in addressing this aspect of the project more fully.

5. Effective dissemination strategies

<table>
<thead>
<tr>
<th>Extent</th>
<th>No response</th>
<th>0 None</th>
<th>1 Very low</th>
<th>2 Small</th>
<th>3 Reasonable</th>
<th>4 Good</th>
<th>5 Very good</th>
</tr>
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<tbody>
<tr>
<td>N=9</td>
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<td></td>
<td>2</td>
<td>6</td>
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</table>

Diffusion (ie to spread widely to reach a large area) is almost inevitably outside of the time constraints of such a project as this and, as argued above, probably the true test of the success of this project will be the extent to which team learning is seen as good practice in Architecture and related design areas in the higher education sector within the next 3-5 years and the extent to which the materials provided have been used and deemed helpful. To reach a larger audience than those involved in the trials and the development of the case studies at the 4 partner institutions, it is important that realisable dissemination strategies are conceptualised and achieved in a timely manner.

The project has already disseminated its findings through the 2 national teaching symposiums and workshops at the lead institution. The national survey, while primarily for data collection, also brought this issue to the attention of students and teachers nationally. 1 paper has been published and 3 further papers submitted for publication in international scholarly journals. 2 conference papers have also been presented and published, one in Canada and the other in New Zealand.

The website is the prime dissemination vehicle. Teachers and students (and other interested parties) are able to access the manuals and other important resources such as an annotated and themed bibliography on teaching and assessing teamwork and also the case studies. Newsletters updating the project’s progress as listed in the dissemination framework in the grant proposal (pp6-7) have been provided up to December 2013 (number 8 of a projected 12). For the website to disseminate the project successfully, it needs to be brought to the attention of stakeholders. As the national surveys were accessed through the website, students and teachers had an opportunity to look beyond the survey to the site’s structure and contents. The Final Report (p37) notes that a
web-based discussion forum will go live via mail-shot to teaching champions in March 2014 and OLT, itself, will presumably play an important role in publicising this through cross-links from its website. The grant proposal (pp6-7) lists a 2 volume publication as part of the dissemination plan for this project. This was intended to be written and distributed to all Australian university directors/heads of teaching and learning centres/institutes. As noted in the Final Report the budget did not support this major endeavour and neither did the time allocation of the project team. At this stage a detailed book proposal, including an outline and sample chapter, has been submitted to 5 prospective publishers and the project leader is confident the book will be completed and published, albeit outside of the life of this particular project. Although not as planned, this should have two advantages: it will ensure that studying group and team work and contributing to our understanding will continue and the publication will bring the findings from the project to an international audience of far greater diversity than heads of Australian teaching/learning centres. In the judgement of a member of the reference group:

The project provides extensive exempla and analysis of background literature and case studies aimed at supporting the learning of team working skills through teaching and assessment. Many insightful views are comprehensively presented and carefully analysed and contextualised. This is also testified by the authoritative outputs of the project in terms of dissemination to the academic and scientific community, encompassing a conference paper, and – more substantially – a journal paper (of significant interest) and a book proposal.

While there is no question of the usefulness of the resources, some project team members, as is arguably the norm for most of these projects, expressed concerns regarding reaching out to academics who are reluctant and/or disinterested. As well as ensuring the ‘digestibility’ of the information and its ready access, dissemination to all stakeholders – including the professional bodies and employers – will depend on the communication strategies set in place as the project concludes.

6. Conclusion

This evaluation identified specific indicators of success and has assessed the project against these. Within the time and budget constraints of this project, the project team members – most especially the project leader - worked assiduously to meet their stated goals. While this audit has determined there were some areas where the project did not proceed as intended, these are recognised and were addressed.

Significantly, this project has worked to enhance approaches to group and team work in the design domain in the partner institutions and, in doing so, has increased our knowledge and understanding of their impact on tertiary education. The framework, handbooks and suite of recommendations usefully targeted to each stakeholder group, should prove to be valuable additions to the literature that lead to practical outcomes, with additional useful information stemming from this project also being available on the project website. It is reasonable – and, indeed, a valuable result - that some of the major outcomes of this project will occur beyond the time of this project’s funding.

If, as is probable, accreditation parties recognise the need for student exposure to and experience with group and team work, the probability of its becoming part of all curricula will be assured. Should this occur, this project will have played an important role in defining tertiary pedagogy in this critical area and also provide significant resources to assist the resultant learning to be a valuable experience for those concerned, learning that results in better prepared professionals.
PART A

1. What do you believe was needed for this project to achieve its stated outcomes?
Using the scale provided, please complete the table below to indicate:

(a) The extent to which you believe each requirement has been met
(b) Why you provided that rating and/or any other comment(s) you wish to make.

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>EXTENT 0-5</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Effective project leadership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Strong project management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Shared understanding of the project’s desired outcomes and what is needed to achieve these</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Sustained effective partner contributions</td>
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<td></td>
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<tr>
<td>5 Appropriate guidance from the reference group</td>
<td></td>
<td></td>
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<tr>
<td>6 Adequate institutional support</td>
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<tr>
<td>7 Useful deliverables</td>
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<tr>
<td>8 Effective dissemination strategy(ies)</td>
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<td></td>
</tr>
<tr>
<td>9 OTHER: please specify</td>
<td></td>
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</tr>
</tbody>
</table>

SCALE:
N/A  Not applicable (as far as you are concerned) and/or unable to judge
0    To no extent                                                             1  To a very low extent
3    To a reasonable extent                                                 4  To a good extent
5    To a very good extent
PART B

This project has 3 stated outcomes.

1. Please complete the table below using the scale provided below to indicate:
   (a) The extent to which you think the team has achieved each outcome
   (b) Why you provided that rating and/or any other comment(s) you wish to make.

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>EXTENT 0-5</th>
<th>COMMENT</th>
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<td>Investigation of how best to support the learning of teamwork skills through teaching and assessment</td>
<td></td>
<td></td>
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<tr>
<td>Provision of curriculum renewal proposals to include a structured framework for teaching teamwork skills with an associated suite of assessment tools</td>
<td></td>
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<tr>
<td>Development and documentation of best-practice models of assessing individual contributions to teamwork</td>
<td></td>
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</tr>
</tbody>
</table>

SCALE:
0 To no extent            1 To a very low extent            2 To a small extent
3 To a reasonable extent  4 To a good extent              5 To a very good extent
2. **Your substantive contribution to this project**

Please complete the table below using the scale provided to indicate:

(a) What you believe has been your substantive contribution to the project
(b) Why you provided that rating and/or any other comment(s) you wish to make.

<table>
<thead>
<tr>
<th>CONTRIBUTION</th>
<th>EXTENT 0-5</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**SCALE:**

0   To no extent  
3   To a reasonable extent  
1   To a very low extent  
4   To a good extent  
2   To a small extent  
5   To a very good extent

2.2 What, if anything, do you believe you have gained from contributing to this project?

Please add any further comments you feel would assist the evaluation of this project.
Appendix 2

Enhancing and Assessing Group and Team Learning in Architecture and Related Design Contexts

Interim Evaluation Report     December, 2012

Introduction

The agreed and stated purpose of this evaluation is to give the team information about how the project is going to this point and to seek guidance to assist the project to achieve its aims in the most effective way possible. Comments such as “It [completing the survey] did the purpose in getting me to reflect to try and think of constructive strategies and how further to be involved” and “Completing this survey is helping [me deal with a given issue]” suggest the survey the 6 project team members completed assisted the project moving forward by creating an opportunity for team members to reflect and articulate.

This interim evaluation draws on:

- Discussion with the project leader
- Email exchange and telephone conversation with a member of the project’s reference group
- A survey of the 6 project team members
- Review of project documentation

As two project reports to the Office for Learning and Teaching have been provided (April and October 2012), the statements of completed work are not repeated here. Rather, the emphasis is on team perceptions and the identification of areas that could be strengthened with some recommendations being offered for the team to consider. This report also does not seek to evaluate the quality of the deliverables from the project and it is noted that this is the responsibility of team members and the reference group. How the utility of these deliverables from the viewpoint of relevant stakeholders will be considered is an important issue to determine: See Recommendation 6.

The link with the Canadian universities should be a particularly valuable part of this project and this aspect will need to be considered in the final evaluation.

Two questions that formed part of the survey at the request of the project leader concerning future contributions to assist the project’s dissemination and budget advice to inform future projects have been separately reported to him as they fall outside the scope of this brief.

Findings

1. Perceived value of the project

This project is well positioned to increase understanding of group and team learning and articulate diverse strategies to support these activities in Architecture and related design contexts. While this will, presumably, impact on many educators as resources are gathered and disseminated, there is compelling evidence that those within the project team and beyond (through the Symposium, in particular) are already learning from one another with instances of productive changes to pedagogical practice already being noted.
2. Achievement of outcomes

Review of the documentation and analysis of the perceptions of the project team indicate that a solid foundation has been established and the project is well positioned to achieve its 3 stated outcomes:

1. Investigation of how best to support the learning of teamwork skills through teaching and assessment
2. Provision of curriculum renewal proposals to include a structured framework for teaching teamwork skills with an associated suite of assessment tools
3. Development and documentation of best-practice models of assessing individual contributions to teamwork

It appears there is a good range of experience from which to draw and the initial enthusiasm for the project is being sustained. The first National Teaching Symposium coupled with a meeting of the project reference group has given the project a sound basis. There is clear evidence of agreed actions being taken within the scheduled timeframe and significant data collection. There is evidence also of some resultant analysis and reporting and indications that data collected so far has been used to inform aspects of the project, an approach that needs to be built on. Some team members are concerned, however, that, while the data collection is well established, analysis and development of this material to meet clearly defined ends and audiences still require considerable work: See Recommendation 1.

While predominantly positive (ie 3 ‘to a reasonable extent’ and above), it is significant that project team members had a broad range of responses (1 ‘minimal’ - 5 ‘very good’) to the extent to which they believe the team is on track to achieve each of these outcomes. It is also important to note that the most positive responses (invariably 4-5) came from the Research Fellow as this suggests a different and generally more positive set of perceptions by the person who is arguably most closely involved with actualising these outcomes from those of the rest of the team.

The second outcome (provision of curriculum renewal proposals) is causing most concern. It is apparently the least discussed aspect and there is less confidence about how this will be achieved: See Recommendation 2.

The team recognises that there is still much to achieve – “it will need to significantly ramp up next year” – but the fact that this is recognised, and several team members have expressed their willingness to be more actively engaged are encouraging signs.

3. Identified pathways to success

The project team members were given a list of 5 perceived requirements derived from experience with similar projects and asked to rate each and comment. They were also invited to add other dimensions. Only one person took this opportunity, adding ‘partner contribution’ which was rated at ‘3’ so ‘reasonable’ with the comment that, while the partners have been responsive, a more proactive intervention and guidance, at times, would have been useful. Sustained partner contribution is certainly important and the impression to this point is that, as could reasonably be expected, this varies with individuals and with the time available. There is solid evidence that partners have been actively involved in pilots and discussion and in giving feedback. Partners were asked to describe and rate their contribution and this ranged from 1.5 to 4. Lower responses were attributable to unexpected disruptions that impacted on available time and also courses that could have been included, but there were some suggestions that, for a project dealing with team work, the leadership while well-regarded and described as ‘excellent’ is perhaps taking on too much of the responsibility and more opportunities should be provided for meaningful contributions by others: See Recommendation 3.
Effective project leadership and strong project management are recognised hallmarks of project success. Conflating the roles of project management and research into the one position of research fellow apparently put pressure on the budget and, while there are important synergies in combining these elements, covering all the requirements for each in a highly professional manner is a challenge.

The project has suffered some problems directly attributable to the inexperience of both the project leader and the project manager. The project leader is candid regarding his inexperience and quick to point to problems that this has caused (eg with budget estimates and time taken to recruit). The project manager is also aware of some areas (eg the organisation of the Symposium) where lack of experience meant some basic things were not covered. It appears both have learnt from the experience and any problems have been satisfactorily resolved. However, if each had a trusted mentor (Recommendation 4) this would support the good relationship apparent between the project leader and the research fellow to the benefit of both and the project.

The project leader’s consultative approach is valued and full team engagement should lead to commitment to undertake the demanding completion goals. At the same time, busy people prioritise and setting short-term to medium goals as well as ensuring meeting time is spent dealing with significant issues that require the attention of all team members should encourage participation. It is essential to move from discussion to action items and monitor these closely and to bring closure at key times: See Recommendation 5.

Team members are confident, in the main, (five 4-5 ('good'/‘very good’ responses and one 3 ‘reasonable’) that there is a shared understanding of the project’s desired outcomes and what is needed to achieve them. While atypical, comments such as “I still have concerns in this regard, because I am not completely sure of the outcomes and what they will look like” are a cause for concern and need to be addressed: See Recommendation 2. Any reservations expressed were related to the perceived usefulness of the deliverables. Those involved in projects of this nature tend to feel they are ‘preaching to the converted’ and key areas such as the criteria that will be used to judge usefulness need to be resolved: See Recommendations 6 & 8.

There is a shared recognition that dissemination is a critical factor and multiple avenues are being considered: local forums including guest lectures and workshops, conference contributions, journal articles and books as well as websites. There is recognition also that this project requires practical guidelines premised on robust scholarship and these must be readily accessible. While the diversity is to be applauded, and, wherever possible gaining multiple outcomes from the one endeavour should be encouraged, a clearer identification of what each of these requires and a schedule established documenting responsibility as well as setting deadlines seem needed: See Recommendation 7. This should assist prioritisation and allow team members (and others) to contribute where they feel they can make the greatest impact.

Timely delivery is another important issue. While reference was made to some slipping behind schedule, the fact that the project started late and has an extension, as well as documentation of project elements that incorporates dates should mean this should not be an impediment to the successful completion of the project.

4. Identified challenges

While the strong impression is that this project is progressing well, budgetary constraints are impacting on critical aspects such as dissemination. Given the problem of recruiting students to attend focus groups, it is reasonable for the team to consider alternative and less expensive ways to gather student feedback regarding the pilot units. Providing opportunities for project team members and the reference group to meet face-to-face would possibly be a more useful use of resources: See Recommendation 3.
If, as has been claimed, many academics have no interest in this important topic, arguably the most important challenge for this project is to **provide resources that engage and convince**: See **Recommendation 8**.

**Recommendations for consideration**

1. Analyse and then consolidate all data at key determined stages with well crafted, considered work that is peer reviewed and then used to inform the next stage(s) of the project.

2. Revisit the outcomes/deliverables, especially the provision of curriculum renewal proposals, to ensure/reinforce a shared sense of what is required as well as how, when and by whom they will be achieved.

3. Canvass how members of the project team intend to use the remaining time, working as individuals or in smaller groups to achieve specified outcomes in agreed key areas. Consider if it is possible to have face-to-face meetings/workshops and, if so, when, where, and for what purpose(s). Where possible, include the reference group.

4. Put in place a mentor with the requisite experience and time and who is welcomed by the individuals concerned to support the project leader and research fellow and act as a critical friend to them.

5. Ascertain the extent to which all project team members wish to be involved in organisational/operational aspects so that attention within the wider project team is focussed on significant areas that need discussion and timely resolution.

6. Determine how the utility of these deliverables from the viewpoint of relevant stakeholders will be considered, including establishing the criteria that will be used to judge usefulness.

7. Articulate a more achievable dissemination strategy with a clearer rationale and identification of what each element requires and a schedule established documenting responsibility as well as setting deadlines. Delegate/encourage input and involvement from the reference team and other identified resources as well as from members of the project team. Prioritise as necessary.

8. Give explicit attention to how to provide resources that engage and convince a wide cross-section of the academic community.