

Conceptualizing teamwork and group-work in architecture and related design disciplines

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ABSTRACT: This paper reports on the early findings of an Australian Learning Teaching Council (ALTC/OLT) funded project – “Enhancing and Assessing Group and Team Learning in Architecture and Related Design Contexts.” This is a two-year project investigating good practice in Australian higher education for the teaching of teamwork in the design disciplines, with a focus on architecture. Drawing upon a review of the literature and discussions with teachers and practitioners, the paper considers how teamwork is conceived in the context of the design disciplines. The paper explores notions of team and group design activities in the literature, identifying the key elements and characteristics of effective teams and groups. While a great deal of research exists on effective teamwork in organizational, management and general education literature, this research found a clear gap in knowledge relating to teaching teamwork in architecture and related design contexts. Suggestions are made about the ways in which theories on effective teamwork in organisations might elucidate teaching and assessment of effectively functioning student design teams.

The literature review prompted five key questions, outlined here, around the conceptualisation of teamwork in design education that were subsequently discussed with educators and practitioners, thus allowing the identification of issues, problems and solutions common to all fields of design.

Conference theme: built environment education
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INTRODUCTION

While individuals will always assert their identities in the design process, collaboration is the linchpin of design practice. Large and complex projects rely heavily on the collaborative effort of multi-disciplinary teams with a range of expertise and knowledge, from planning to design and construction, as well as of client groups and government organisations. In the context of higher education, the importance of collaborative learning - the grouping and pairing of students to achieve academic goals - has long been recognised, with teamwork commonly stated by employers as a key academic competency. In design and architecture education, the importance of collaborative learning is linked to two factors: first, the demands of the design practice for graduates with collaborative skills, and, second, its benefits for formal and informal learning. Yet despite the widespread use of collaborative learning, and regardless of a multiplicity of approaches to it, two obstacles to effective teaching can be identified: the inadequacy of the specific teaching of teamwork skills and processes, and a lack of a structured method of integrating team and group work into the curricula and assessment.

In recognition of these obstacles, the authors of this paper are leading an ALTC funded project that is addressing three primary research questions: how do we teach teamwork skills in the context of design?; how do we assess teamwork skills?; and how do we fairly assess individual contribution to team designs? The answers to these questions will inform a pedagogical framework to assist teachers of architecture (and other design and applied arts disciplines) to: develop innovative approaches to collaborative studio-based learning in multi-disciplinary and mono-disciplinary contexts; structure group work and teamwork within curricula; develop graduate attributes for teamwork; and assess collaborative design in a consistent, transparent and objective manner to support team-working skills and increase learner confidence. The framework will recognise the teaching implications of two modes of collaborative learning: teamwork and group work. This distinction acknowledges the key difference between students collaborating on one assignment (teamwork) and students working together on individual assignments (group work).

As a precursor to addressing these pedagogical issues, the role that teamwork plays in design practice and design education has been researched by documenting and elucidating conceptions of teamwork in these contexts. This research consisted of three stages: the first was a literature review on teamwork in higher education and practice, the second a survey that sought position statements from design teachers and practitioners around key themes identified in the literature review. The position statements were structured around five questions exploring the conceptualisation of teamwork in design education and practice. The third stage was a national teaching symposium that discussed and expanded upon these position statements. This paper can be divided into two sections: the first is a summary of the key themes conceptualising teamwork in the reviewed literature, and the second reports on the conclusions drawn from the symposium discussions around the position statements.

1. LITERATURE REVIEW

To develop a wide-ranging understanding of the issues that impact collaborative learning, 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 on understanding the processes underlying team effectiveness, to writings on corporate training aimed at increasing the effectiveness of work-place teams. A brief summary follows of the elements of this review pertaining to the overall conceptualisation of teamwork in design. The summary is divided into three parts: a definition of terms followed by two sections outlining the eight themes we have identified in the literature as important to conceptualising teamwork. The first of these two sections looks at types of teams, and outlines: (1) the distinction between groups and teams; (2) the characteristics of effective teams; and (3) virtual teams. The final section identifies team characteristics that impact upon learning in those teams: (4) the factors and processes involved in collaborative learning; (5) the consequences of team size on teamwork; (6) social and cultural diversity in teams; (7) team formation; and (8) conflict resolution.

1.1. DEFINITIONS

A group was defined as “a collection of two or more people who interact and share some common attribute or purpose” (Plotnik & Kouyoumdjian 2011:626). Homan (1951:1) gives another definition as “a number of persons who communicate with one another often over a span of time, and who are few enough so that each person is able to communicate with all the others, not at second-hand, through other people, but face-to-face”. A number of elements have been identified as essential to a group, regardless of its purpose, relating to the combinations of its members, its objectives, purposes, activities and processes. These common features inform: ‘shared goals’ (e.g. Johnson and Johnson 1991); ‘group cohesion’ (Beatty, Haas et al. 1996); ‘group norms,’ which determine expected types of behaviours and define unacceptable behaviours; interdependence (e.g. Lewin 1951; Skilton, Forsyth et al. 2008); ‘communication’ and ‘face-to-face interaction’. The term team often refers to a group that is able to perform well, such that a team is defined as “a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable” (Katzenbach and Smith 1993:45). This definition suggests ‘diversity’ in terms of members’ skills as a distinguishing feature of high-performance teams (Smith and Imbrie 2007). In the context of education, various terms are used to refer to the learning that takes place when students are asked to work in groups: including ‘learning groups’ (Bouton and Garth 1983), ‘collaborative learning’ (e.g. Hamilton 1997; Bruffee 1999), ‘cooperative learning’ (e.g. Slavin 1983; Johnson and Johnson 1991; Johnson, Johnson et al. 1991) and ‘team-based learning’ (e.g. Michaelsen 1983; Michaelsen and Black 1994; Michaelsen, Black et al. 1996).

1.2. CONCEPTUALISING TYPES OF TEAMS

1.2.1. The Distinction between a Team and a Group

The terms ‘team’ and ‘group’ have been used interchangeably. A basic commonality between a group and a team is that they are both composed of two or more individuals acting together in a mutual activity. However, a team is understood to have certain features that distinguish it from a group. In the work environment, for example, “a team’s strength depends on the commonality of purpose and interconnectivity between individual members, whereas a group’s strength may come from sheer volume or willingness to carry out a single leader’s commands” (Pollick 2012). Katzenbach and Smith (1993) argue that the key differences between a team and a group lie within four areas of ‘leadership’, ‘accountability’, ‘processes’ and ‘final product’. Thus: (1) there is usually a strong and clearly focused leader in a working group, whereas a team has shared leadership roles; (2) in a team, there is both individual and mutual accountability, as opposed to groups, which rely solely on individual accountability; (3) while groups are generally perceived to run efficient meetings, discuss, decide and delegate, teams are described as more likely to be involved in open-ended discussion and active problem-solving meetings, and to ‘discuss’, ‘decide’ and ‘do;’ (4) the final output of a group can be distinguished from that of a team, such that a group collates a number of individual works compared to a team that develops a collective product. Forming groups and teams is another dimension of these distinctive characteristics (Katzenbach and Smith 1993). Forming a group appears to be much easier than forming a team. While certain commonalities or even a single commonality can be used to form groups, team members may be selected for “their complementary skills, not a single commonality” (Pollick 2012).

In addition to these differences, there are two further factors that have been identified as distinguishing a team from a group: commitment and trust (e.g. Woodcock 1979; Mickan and Rodger 2000; Crossman and Lee-Kelley 2004; Park, Henkin et al. 2005; Chiochio, Forgues et al. 2011; Etroo 2011). Members of an effective team demonstrate a strong commitment to their fellow participants and a high level of trust exists among them. Before any group can transform into a team four steps need to be taken, including: ‘spending time interacting’, ‘using resources’, ‘working on a difficult task which serves as a mutual objective for all members’ and ‘having the opportunity to give and receive feedback on the team outcomes and the performance of individuals’ (Michaelsen, Knight et al. 2002; Fink 2004; Michaelson, Knight et al. 2004).

1.2.2. Characteristics of effective teams

It is generally agreed that the development of an effective team depends on the mutual effort of all team members, their collaborative skills and an understanding of what constitutes high performance. Oakley et al. (2004:13) describe an effective student team as a group of individuals who “always work together—sometimes physically together and sometimes apart, but constantly aware of who is doing what.” As such, they suggest that roles and responsibilities are clearly assigned, and team members “help one another to the greatest possible extent, resolve disagreements amicably, and keep personal issues (which may occur when any collection of people work together) from interfering with the team functioning” (Oakley, Felder et al. 2004:13). Caspersz et al. (2004) point to team-level factors that influence effective performance of student teams, including: “intra-group trust, communication and cooperation”, “workload sharing and shared leadership” and “team member satisfaction and interpersonal work group processes.”

Similarly, McGourty and De Meuse (2001) define four 'team effectiveness dimensions': *collaboration, communication, decision-making and self-management*. *Collaboration* refers to showing commitment to the team's overall purpose, working cooperatively with others, active participation in team activities and demonstrating support and encouragement for teammates. *Communication* refers to an attempt to maintain an environment where everyone can freely express his/her ideas, the clear and concise expression of ideas and reflective listening. *Decision-making* refers to collecting information and assessing alternatives, innovative thinking and development of a rationale to guide any decision made. *Self-management* refers to the application of appropriate methods and procedures to guide team members towards achievement of team goals, sensitivity to individual and group processes and adopting and modifying behaviours to achieve results.

We have identified in the literature seven categories for the key characteristics of effective teams: (1) goals and objectives; (2) structure and plan; (3) communication and information exchange; (4) cooperation and interdependence; (5) flexibility and self-management; (6) leadership and accountability; and (7) evaluation and Reflection. Thus, effective teams are said to have goals that are clearly stated, accepted, shared and well-understood by all team members, and members of effective teams demonstrate commitment to team goals (Woodcock 1979; Mickan and Rodger 2000; Mickan and Rodger 2005; Wheelan 2009). Team goals are formed as a result of cooperation among team members and are changed or modified to achieve "the best possible match between individual goals and the group's goal" (Johnson and Johnson 1991:20). Effective teams have a plan outlining milestones, key decisions and actions, as well as clarity of the roles and responsibilities of team members (Adams, Simon et al. 2002). There is also "a dynamic exchange of information and resources among team members (McGourty and De Meuse 2001:4)." In an effective team, communication is two-way and members are encouraged to freely express both ideas and feelings (Johnson and Johnson 1991). Building on constructive communication, roles are required to be clearly defined and appropriately assigned to team members according to their expertise and skills. Members of an effective team coordinate tasks among themselves and have a high level of interdependence on each other in order to achieve the desired outcome (e.g. McGourty and De Meuse 2001; Ulloa and Adams 2004). Effective teams experience "ongoing adjustments to both the team and individual task demand" (McGourty and De Meuse 2001:4). An effective team is also characterised by distributed leadership and participation, and members are mutually accountable for team performance (e.g. Johnson and Johnson 1991; McGourty and De Meuse 2001). Successful teams have leaders managing the team processes and roles in an ongoing discussion and negotiation with team members. Finally, members of an effective team are engaged in continuing self- and peer-evaluation, monitoring the progress of teamwork and establishing strategies to assess team performance (e.g. Johnson and Johnson 1991). In addition to these seven categories, Larson and LaFasto (1989) point to two supplementary factors characteristic of effective teams; positive team culture and external support or recognition. The positive team culture has four elements of honesty, openness, respect and consistency of performance (Larson and LaFasto 1989). Enjoying a positive team culture and interpersonal behaviours are stressed in an effective team and cohesion is developed through a high level of inclusion, affection, acceptance, support and trust (Johnson and Johnson 1991). Moreover, successful teams effectively utilise existing resources and team members' skills (Larson and LaFasto 1989).

1.2.3. Virtual Teams

As combinations of synchronous and asynchronous communication technologies have replaced or augmented face-to-face interaction, prominence has increased of the 'virtual team', defined as a "team whose members share a common purpose or goal, work interdependently and are geographically isolated from one another" (Cochrane, Brodie et al. 2008:2). In the context of design, this prominence has been echoed by the emergence of the virtual design studio (VDS). The rapid rise of virtual teams is reflected by a proliferation of research in this area, although the majority of this has focused on virtual teams in business organisations. There is significantly less research on learning in virtual teams, and significantly less again on designing in virtual teams and learning how to design in virtual teams.

The significance of developing skills to act as an effective member of a virtual team has been recognised by a number of authors (for instance, Ale Ebrahim, Ahmed et al. 2009; Dool 2011). Some have examined the factors that may contribute to conflict in virtual teams (Bosch-Sijtsema 2007; Kankanhalli, Tan et al. 2007; Dool 2011), and have proposed conflict resolution mechanisms for these contexts (Shin 2005). Rezgui (2007) investigated the effectiveness of virtual teams in the construction sector, and identified the factors that contribute to their success. Resta and Laferriere (2007) carried out a meta-analysis of the research conducted since 1987 on the application of technology in support of collaborative learning in higher education, and Smith (2008) completed a comprehensive literature review about learning experiences in virtual teams. Sher and Williams (2007) explored the implementation of assessment strategies for students working in a virtual environment and also reported on the experiences, benefits and challenges faced by these students. Ale Ebrahim et al. (2009) conducted an extensive literature review of the definition, types and underlying characteristics of virtual teams as well as the key factors involved in effective virtual teamwork.

Whilst the majority of design learning and teaching still takes place face-to-face, since the early 1990s students and teachers have been exploiting the possibilities that digital media and virtual environments offer the design process (Kvan 2001). As Ham and Schnabel have discussed (2011), the advent of Web 2.0 technologies and social network platforms have seen further innovation in the use of the VDS in many schools of architecture. In particular, the ease of communication, interaction, teamwork and sense of community offered by social networks (Owen, Grant et al. 2006) and the opportunity for synchronous drawing offered by multi-user three-dimensional computer aided design tools such as BIM (Building Information Modelling), has seen design collaboration move beyond physical learning spaces to environments that offer opportunities for engaging in teamwork via on-line and blended models of learning.

1.3. CONCEPTUALISING EFFECTIVE LEARNING IN TEAMS

This paper now considers the characteristics of teams that affect learning in teams. Impacts on the effectiveness of collaborative learning can be divided into two categories: (1) the characteristics of the group or team, and (2) collaborative processes. 'Team/group size' and 'social and cultural diversity' have been identified as the two key characteristics impacting on how members of a team or a group work together, on what they experience and on the quality of the collaborative product. A number of small-scale studies (Oakley et al. 2007), and a few large-scale longitudinal studies, have examined optimal conditions for teamwork in academic settings (e.g. Fiechtner and Davis 1985; Riordan, Street et al. 1997). Drawing on these studies, two key team processes have been identified as having significant impacts on team performance: 'team formation' and 'conflict resolution.'

1.3.1. Team size

Research is inconclusive surrounding the effect of team size. For example, Bacon et al. (1999) found no relationship between team size and best or worst team experiences or processes. The authors recommend electing team size by pedagogical objectives, such that, "the team size should be set at the smallest number reasonable for accomplishing these objectives. Larger sizes simply allow students to become less active in the learning process" (Bacon, Stewart et al. 1999:484). While there is no common agreement on the optimal size of teams or groups, many researchers recommend three as the minimum and five the maximum size for student team or group assignments (Oakley, Felder et al. 2004).

1.3.2. Social and Cultural Diversity

Social and cultural diversity factors that influence team and groupwork include race, age, gender and culture. Bear and Woolley (2011) reviewed literature on the role of gender in team processes and performance. Their review showed "recent evidence strongly suggests that team collaboration is greatly improved by the presence of women in the group" (Bear and Woolley 2011:146). According to the authors, the positive effect of women's participation in the group is primarily explained by benefits to group processes. Research suggests some negative impacts of cultural diversity on team processes and function (e.g. Watson and Kumar 1992), including: "process loss' arising from inability to communicate clearly, frequent disagreements on expectations, and attitudinal problems such as dislike, mistrust and lack of cohesion" (Adler 1997, as cited in Caspersz et al. 2004). This does not mean that cultural diversity should be avoided in teams. If managed effectively, cross-cultural teams can lead to workforce productivity (e.g. Cox and Blake 1991; Adler 1997; Distefano and Maznevski 2000; Richard 2000). It is recognised that the way in which cultural diversity is managed in teams is important, and in the context of learning this means that students should be taught skills to accept diversity.

1.3.3. Team Formation

Three main approaches to assigning students to teams have been identified: self-selection, random assignment and teacher assignment (Bacon, Stewart et al. 1999). A number of benefits have been identified in 'self-selection': it is suggested to offer higher initial cohesion (Strong and Anderson 1990); it has been linked to student team performance (Gosenpud and Washbush 1991); it is associated with students taking increased ownership of group problems and thus managing interpersonal conflicts more effectively (Mello 1993); and self-selection is seen as leading to greater team productivity due to the establishment of team-related norms in student teams with a history of working together in past courses and classes (Bacon, Stewart et al. 1999). Despite these benefits, self-selected teams are exposed to being overly homogeneous (Jalajas and Sutton 1984-1985), lack the advantages that diversity may offer (Bacon, Stewart et al. 1998), can result in an inadequate combination of skills (Mello 1993), and can lead to the 'Self-Fulfilling Prophecy in the Classroom' (Tucker and Rollo 2006).

Bacon et al. (1998:69) suggest that 'random assignment' is "just as unfair as randomly assigning grades—each student would have the same probability of getting an A or an F, regardless of their abilities or efforts." This approach to team formation is also seen as having a high probability of leading to unbalanced teams in terms of skills, diversity, and general ability and fail "to generate teams with a useful combination of skills, or create groups of students who want to work together" (Bacon, Stewart et al. 1998:69).

'Teacher assignment' is preferred by some researchers (e.g. Fiechtner and Davis 1992; Oakley, Felder et al. 2004; Tucker and Rollo 2006). Oakley et al. (2004:11), for example, suggest that when students are allowed to select their own teammates, stronger students have a tendency to seek one another out, "leaving the weaker ones to shift for themselves, which works to no one's benefit." The authors argue for well-functioning diverse groups within which "the weak students get the benefit of seeing how good students approach assignments and they may also get some individual tutoring, while the strong students who do the tutoring may benefit even more" (Oakley, Felder et al. 2004:11).

1.3.4. Conflict-resolution

While learners can benefit from teamwork by sharing ideas, learning from the experience of others, experiencing less isolation, gaining moral support, and by combining individual competencies, students can also experience difficulties detracting from these anticipated benefits; such as conflict and lack of commitment by other students (Felder and Brent 1994). The ability to resolve conflict has therefore been recognised as a highly influential skill towards achieving effective teams. For instance, the findings of a longitudinal study carried out by Tekleab et al. (2009) suggested that conflict management has a direct, positive effect on team cohesion, with team cohesion positively related to perceived performance, satisfaction with the team, and team viability. Conflict management is a chief topic of investigation in research on collaborative design in the workplace (e.g. Klein and Lu 1990; Slimani, Da Silva et al. 2006; Velasquez, Lara et al. 2008; Jin, Ying et al. 2009). While conflict in student design teams has not been the focus of literature, conflict in student teams in general has been considered (e.g. Bolton 1999; Chen and Lou 2004; Dool 2010; Goo 2011). It is clear from most of the research in this area that when team members come from different social, cultural and cognitive backgrounds and have different expectations, motives, ideas, opinions, personalities, values and preferences, these differences can lead to conflict (See for instance Kilker 1999; Kilker 1999; Dreu and

Vianen 2001; Mohammed and Angell 2004). From an alternative perspective, conflict in teams is not always a negative process but can “enhance the quality of decision making and actually increase the overall cohesiveness of the team” (McGourty and De Meuse 2001:32). While conflict can be beneficial to the functioning of the team, lead to good quality outcomes and may not be avoided within student teams, we have found general agreement in the literature that it is critical to constructively manage it in order to ensure effective team performance.

2. FIVE QUESTIONS ON CONCEPTUALISING TEAMWORK

A national teaching symposium was held to discuss the underlying conceptions of teamwork and collaborative learning that are held in design higher education and in design practice. Participants were selected via emails sent to the heads of design schools in Australian higher education institutions to identify teachers who have researched in, or who are known for innovation in, the area of collaborative learning. Twenty-four teachers from a range of design disciplines participated in the symposium, with a number of these also practitioners. The disciplines represented were: Architecture, Art and Design, Communications Design, Construction Management, Engineering Design, Graphic Design, Industrial Design, Landscape Architecture, and Theatre Design. The five questions were informed by key issues arising from the literature review presented above. These questions were:

1. Is there still, or was there ever, a place for the individual in contemporary design practice?
2. Should a team member stand out from the rest of the team and be acknowledged for their contribution?
3. What are the boundaries that differentiate between the memberships of teams and groups?
4. Are students able to work better in parallel than collaborate?
5. Is teamwork only learned through experiential learning, or can it be taught?

Participants were asked to submit written responses to these questions prior to the symposium. During the first session of the symposium, five to ten minutes were allocated to each participant to present a position statement based around the symposium questions. In the second session, symposium participants formed four teams to discuss assessment of teamwork. A representative from each team then presented an outline of the team discussion to the rest of the participants. In addition to the teachers attending the symposium, four teachers who could not attend submitted position statements on the symposium questions. A brief summary is now presented of the common themes that emerged both from the written answers to the five questions and from the symposium discussions.

2.1. Is there a place for individuals in contemporary design?

The symposium participants shared the view that there is a tendency towards acknowledging and linking the celebration of creativity to the work of individual designers within the context of design practice. On the other hand, complex design projects increasingly rely on the joint contribution and collaboration of different experts. While small-scale and less complicated design artefacts such as jewellery, furniture and graphic design may be handled by individual designers, innovation in complicated design problems, for instance in the fields of architectural and urban design, requires large teams of individuals working together. In larger scale projects, the emergence of large corporate architectural practices and multi-disciplinary firms has reflected a need for diverse teams of design professionals; including structural engineers, architects, interior designers, landscape designers, lighting and acoustics experts and others. It was concluded that while there is and should still be a place for individuals in contemporary design practices, those individuals need to be good team players: having the capacity to respond to and work with other people, situations and forces; being good at listening, negotiating, organising and capable of acknowledging others.

2.2. Should individuals stand out in a team?

While the views expressed in relation to acknowledging the contribution of individuals in a team differentiated between different design contexts, a common solution favoured the singling out of individual team members for ‘recognition or reward’ or for ‘censure, development and/or counselling’. Indeed, a good team was suggested to be one within which the different roles of individuals are acknowledged in the production of the work. Within the context of education, an important challenge highlighted was the development of assessment strategies that evaluated both individual and team work, along with both team processes and final outcomes.

2.3. What are the boundaries that define membership in a team and a group?

The key differences between a team and a group were seen to lie in: ‘composition of members’, ‘interdependence’, ‘mutual accountability’, ‘shared authority’ and ‘interactions’. While geographic proximity and sharing a common interest or activity, such as studying the same unit or course, were identified as criteria for the formation of a group, a team was seen to more often consist of members with complementary skills to complete a project or perform a task. Members of a team were understood to: work with a high level of interdependence, share authority and the responsibility for self-management, work toward a common goal, share rewards and feel accountable for the collective performance of the team. A major difference between a team and a group was seen in the level of interpersonal interaction and discussion, such that while a group is comprised of members working individually toward a common goal, in teams there is a high degree of interaction and cooperation. Thus for teams, the boundaries are blurred between individuals, both during the teamwork (i.e. process) and in the final output (i.e. product). Moreover, an effective team was described as emphasising equitable discussion and vigorous debate, leading to consensus-based decision-making. Another factor seen as distinguishing a team from a group was the duration of the collaborative tasks, shared objectives and individual roles. Thus teams often have more specific and long-term goals with assigned roles to members, while groups are created for shorter and more spontaneous objectives and tend not to have clearly distinguished roles for each group member.

2.4. Are students able to work better in parallel than collaborate?

Respondents' commonly suggested that while most students generally prefer working individually or in parallel, as opposed to collaborating, some students willingly seek collaborations with their peers without being required to do so, and more willingly learn collaboratively when a number of strategies are in place, i.e. when the value of team and group work is promoted, when learning strategies are well integrated into the curriculum, when a team task is designed specifically for collaboration, and when students are provided with specific training in teamwork.

It was suggested that a key challenge of collaborative learning in design education is the tendency for students to be more comfortable working in parallel even when teamwork is demanded. Thus, commonplace across disciplines is the scenario early in team design assignments that sees students allocate individual tasks that include *both* research and design, where design is either an individual element contributing towards an overall scheme or is one individual's idea of the overall scheme. This piecemeal process culminates in a 'team' design that, by merely collating individual submissions (or showing clear expressions of them), lacks integration and conceptual cohesion. It was concluded that while there is a place for 'working in parallel' on a team task (usually when researching during the early stages of a design project), along with 'working collaboratively', it is important that students understand which approach is most appropriate to the given task.

2.5. Is teamwork only learned through experiential learning?

While there was general agreement that some theoretical knowledge and explanation of the fundamental skills of teamwork should be taught to enable students to reflect upon and learn from their experiences of teamwork, it was recognised that most of the skills required to work as an effective member of a team need to be exercised, developed and nurtured through learned experiences. It was also suggested that good teamwork can be modelled through the process of team teaching, or via joint-critique. The failure to provide students with appropriate training in, and preparation for, collaborative learning was seen as the main reason why many students dislike team or group work. It was suggested that if teamwork is taught using a well-designed, structured, supportive and interactive framework within which students can design collaboratively, there will be a greater likelihood that students will understand the importance of teamwork to the practice of design, will experience better learning outcomes, and will enjoy designing with their peers.

3. CONCLUSION

Through a literature review and the analysis of the writings and thoughts of design teachers across Australia, this paper has identified eight themes important to understanding how teamwork is conceptualised in design: (1) the distinction between groups and teams; (2) the characteristics of effective teams; (3) virtual teams; (4) the factors and processes involved in collaborative learning; (5) the consequences on teamwork of team size; (6) social and cultural diversity in teams; (7) team formation and; (8) conflict resolution. At a national teaching symposium, five questions were discussed that were informed by the literature review and by the views of the project team on how conceptualisations of teamwork might inform teaching and assessment in the different pedagogical contexts of the many design disciplines. From these questions we have identified the following shared views:

- While there is a place for individuals in contemporary design practices, those individuals need to be good team players;
- Within the context of design education, there is a need for assessment strategies that evaluate both individual and team work, along with both team processes and final design outcomes;
- Key differences of a 'group' and a 'team' are in the composition of members, interdependence, mutual accountability, shared authority and interactions. Members of a team work with a high level of interdependence, share authority and the responsibility for self-management, work toward a common goal, share rewards and feel accountable for the collective performance of the team; while a group is comprised of a number of individuals working individually toward a common goal;
- Students more willingly learn collaboratively when a number of strategies are in place: when the value of team and group work is explained, when the learning of teamwork is well integrated into the curriculum, when a team assignment is designed specifically for collaboration, and when the students are provided with specific training in teamwork;
- Theoretical knowledge of fundamental teamwork skills should be taught to better enable students to reflect upon and learn from their experiences of teamwork. But most of the skills needed to work effectively in teams need to be exercised, developed and nurtured through learned experiences. Good teamwork can also be modelled through the process of team teaching.

What is clear from talking to educators nationally is that relatively few design-teachers focus on the teaching of teamwork skills and even fewer are involved in teaching scholarship or research in this area. It appears that as the teaching of teamwork is largely ad-hoc in Australian design education, there is a clear need for the integration of team and group learning into design curricula. The research also highlighted the need for pedagogical models that not only assess the products of teamwork, but also assess the process of teamwork as well as teamwork skills themselves. Furthermore, as teamwork is listed as a graduate competency by accrediting bodies of design courses, we suggest that the need for the formal assessment of teamwork skills is pressing.

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