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# Is it worth taking time out of first year science courses to explicitly teach team skills?

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We set out to better define which aspects of team work first year science students find challenging and to determine whether students found team training activities, which were embedded in a science course, useful. Our study was conducted at a research-intensive University, in a first year, first semester biology course in 2009 and 2010. The course had approximately 600 students from a diversity of backgrounds, programs and OP scores. Students were required to create a short documentary video as a team of four. Our intervention sought clarification of the difficulties students face when conducting group work, and targeted these aspects via three in-class activities. Student perspectives were gathered using surveys over two years. The survey results indicate that the aspects of team work of most concern to students were: unequal workload, reconciling differences, personal/social, and logistical issues. Each team training activity was useful to one-half to one-third of the cohort of students, and students that found activities useful isolated particular elements of their training that they will use again in future team work scenarios. Students with a positive attitude to team work shifted their reasoning from social elements to those with a more academic element over the semester. These data indicate that embedding activities that explicitly address team issues is of benefit to first year science students, including courses with large, diverse student cohorts, such as first year biology. We recommend that team training activities in first year science courses target unequal workload, reconciling differences, personal/social and logistical issues.

**Keywords:** Large classes, first year, team work

## Introduction

### Reasons for introducing team work into science courses

Team work is a set of skills essential for the modern day professional working in multidisciplinary teams, a mandatory aspect of modern science. Students gain many benefits from working in well-functioning teams, including higher grades, deeper learning, longer retention of information, better communication and teamwork skills and a better understanding of the professional environment for which they are studying (Biggs, 1999; Heathfield, 1999; Oakley *et al.*, 2004; Towns, 1998; Wood, 2009). These benefits are attained when students engage in problem solving and resolving differences of opinion, because in well-functioning teams, conceptual and procedural knowledge is shared in the joint construction of a solution to a problem (Heller & Hollabaugh, 1991; Towns, 1998).

The skills to operate within a team are often required by employers (Attle & Baker, 2007; Goltz *et al.*, 2008; Towns, 1998) but many students emerge with insufficient team skills because much of academic performance focuses on individual rather than group achievement (Goltz *et al.*, 2008), this is in spite of universities listing team skills as one of their graduate attributes. Often students are placed in teams and expected to be successful immediately or to learn the skills as they go with little to no guidance (Prichard *et al.*, 2006). However well-developed team skills are not necessarily innate. For example project or time management skills, conflict resolution or effective communication skills come with experience and training. Some authors recommend explicit steps be taken by teaching staff to aid students in their development of such important team skills (Coleman & McLean, 2002; Oakley *et al.*, 2004; Towns, 1998). But class time is in demand and most university academics ask if it worth taking time out from science classes to explicitly teach team skills. Currently there is little to no empirical data to support such a decision.

### **Student issues with team work**

Although working in well-functioning teams has many benefits, working in dysfunctional groups can lead to a worse outcome than working individually (Oakley *et al.*, 2004). Students and employees consistently report difficulties in knowing how to handle conflict situations which arise in the face of group assignment and team performance pressures (Coleman & McLean, 2002; Oakley *et al.*, 2004). The failure to resolve conflict situations is the cause of 50% of team failures (Coleman & McLean, 2002).

“Hitchhikers” (team members who don’t contribute to team work) are another common problem in teams. Students are more likely to hitchhike when they perceive that the net benefits of free riding are higher than the net benefits of contributing (Bacon *et al.*, 1999; Harkins & Jackson, 1985). Harkins and Jackson (1985) suggest that to alleviate hitchhiking students need to feel that their outputs are identifiable and comparable to other students.

### **Team training has potential to help resolve student issues**

Team training has been demonstrated to improve the functioning of teams (Coleman & McLean, 2002; Goltz *et al.*, 2008; Heller & Hollabaugh, 1991; Holton, 2001; Prichard *et al.*, 2006). In contrast, a team training course that was run separate to content based university courses was found to have no impact on students’ team functioning (Bacon *et al.*, 1999). The separate course had no follow up or connection to other courses. This suggests that team training incorporated into content based courses and tailored to group assignments may be more useful to, and readily adopted by, students than a separate course or workshop. Other studies also report the best outcomes occur when team training is incorporated with group assignments (Moreland & Myaskovsky, 2000; Oakley *et al.*, 2004).

Bacon *et al.* (Bacon *et al.*, 1999) comment that education researchers no longer question the effectiveness of team training. We asked the coordinators of 16 courses in the School of Biological Sciences at The University of Queensland and found that 57% of the courses require students to work in teams, with only one providing considerable team guidance (94% provide no, or only introductory information to working as a team). A large part of the disparity between best recommended education practice and coordinators of university science courses could be due to the high demand on staff time, and because there is little demonstrated evidence within the sciences that team training is necessary or helpful. Bolton (Bolton, 1999) found within the college of business that while only 64% of students reported being somewhat happy with their team experience, 91% of the faculty were at least somewhat happy with their student teams. This might point to a lack of realization on the part of

teaching staff that a problem even exists. There is also a large gap in knowledge about whether the team problems reported in the literature for other disciplines will be the same/similar to those experienced by student teams in biological sciences. This is one of the aspects addressed by this study.

There are many similarities across published team training strategies. Some groups used tests for team fitness such as Bendaly's Team Fitness test which assesses shared leadership, group work skills, climate, cohesiveness and change compatibility (Goltz *et al.*, 2008; Holton, 2001). It is suggested that it is important to explain that working in teams is an essential skill for the work place and that they can learn more from working with peers than from working alone (Townes, 1998). It is also reported to be important to discuss expectations of working in a team (Nazzaro & Strazzabosco, 2003; Oakley *et al.*, 2004; Townes, 1998). Similarly, discussions on personality types and the favoured roles of each team member has been shown to help with team cohesiveness and appreciation of diversity within teams (Goltz *et al.*, 2008; Heller & Hollabaugh, 1991; Holton, 2001; Nazzaro & Strazzabosco, 2003). To teach conflict resolution, role play activities of different scenarios has been shown to be effective (Goltz *et al.*, 2008). Using open group discussion and reflection about how the team functioned and what can be improved also improved the students attitude toward group problem solving (Goltz *et al.*, 2008; Heller & Hollabaugh, 1991; Holton, 2001; Nazzaro & Strazzabosco, 2003; Oakley *et al.*, 2004; Townes, 1998).

When team training was implemented several groups described a change in the dynamics of the teams about two thirds of the way into the assignment, with increases in morale and team cohesion (Coleman & McLean, 2002; Goltz *et al.*, 2008). Students gain confidence from these experiences as they successfully negotiated difficulties and are often more motivated to perform in later assignments (Goltz *et al.*, 2008). This change in attitude following team training is clearly beneficial in multidisciplinary professions such as the sciences.

Aside from improving cohesion and student attitudes within the teams during the team training, some studies found that students actively used the skills they learnt during training in other situations (Goltz *et al.*, 2008; Holton, 2001). Consequently Goltz *et al.* (2008) report that employers of students who had been through the team training program noticed an improvement in graduate team skills. This was the only study that looked beyond the classroom and it provides convincing evidence for the use of team training within degree programs especially as the ability to work in a team is a graduate attribute of The University of Queensland.

The study presented here investigated the effects of team training on student teams in a large, first semester, first year keystone biology course at The University of Queensland.

## Aim

1. To determine if first-year students consider group work difficult, and if so what particular elements?
2. To determine if students find team training exercises useful?
3. To elucidate whether team training changes student attitudes to group work?

## Methods

### University and course context

The team training sessions in this study were implemented as part of a first year, first semester ecology course run at the School of Biological Sciences, The University of Queensland, Australia. The course is a foundational course with an annual enrolment of approximately 600 students. Students in the course come from a wide diversity of backgrounds and interests, representing 25 countries of birth, OP scores from 1 to 12 (mean of 6), 12 programs and 17 - 50 years of age. Within the course, students are expected to work in a team of four over nine weeks to develop a short documentary video (Wilson *et al.*, 2009; Rifkin *et al.*, 2011). Students were allocated to a team according to where they sat in the first practical class. Problems and student complaints about working in teams in previous years led participating teaching staff to incorporate a series of team training activities into the practical classes.

### Description of team training

Four 30 minute team training activities were run throughout the semester as an integral part of the standard three-hour practical classes. Activities were led by the practical group tutor/demonstrator. The content and timing of the sessions was tailored to compliment the progress of the group-based assignment. The first activity was an icebreaker, and focussed upon expectations of team members, personality types and role allocation/discussion (team forming = Activity 1). The second activity highlighted negotiation of conflict (reconciling differences) techniques through two role-play activities (Activity 2). The third activity required students to reflect on their past behaviour and that of their team mates (in accordance to the pre-discussed expectations), and required them to negotiate each members contribution (reflection and workload). This was later followed by an anonymous peer assessment and negotiation of final contributions styled around negotiating authorship order for journal submissions (Activity 3). Further details and activity plans can be found at <http://www.biology.uq.edu.au/staff/louise-kuchel>

Team training activities were incorporated into practical classes in both 2009 and 2010. In 2009 a subset of 94 out of 595 students participated in team training activities. In 2010 all 582 students in the course participated. Team training activities were facilitated by tutors in the course. Prior to each class tutors discussed the activities and how best to implement them with the practical class coordinator.

### Evaluation

Students were surveyed using an online platform 'survey monkey' (<http://www.surveymonkey.com/>) at the end of the semester in 2009, and before and after the team training in 2010. Surveys were constructed and distributed using the online platform. Questions were a combination of multiple-choice and open response. The full survey can be found in the <http://www.biology.uq.edu.au/staff/louise-kuchel>

Untrained students of 2009 were asked to report the difficulties they faced during their group assignment. These results were used to assess whether difficulties reported in the literature (and thus the designed activities) were consistent with the difficulties faced by biology students at the University of Queensland. Trained students in 2010 were also asked to report on the difficulties they faced in their group assignment to assess consistency between cohorts and gauge any possible changes caused by training.

This research was approved by the University of Queensland human ethics committee, project number (2009001049).

### Data analysis

The data collected from answers with simple categorical responses (e.g. yes/no, like/dislike) were used to calculate the percentage of students that gave a particular response. Responses to open questions were analysed using a modified method of thematic or content analysis (as summarized by Stemler, 2001). Long responses to these questions often contained segments pertaining to one of more categories per student, hence data from open questions are presented as the proportion of all identified responses, rather than the proportion of students that gave a particular response. Responses to open questions were categorized under different themes. A master list for each response was categorized by two people independently and cross-checked and adjusted until  $\geq 95\%$  similarity was achieved. One analyst then used the master list to categorize the whole data set. To ensure within analyst consistency a sub-set of thirty categorized responses were then re-categorized at a later date. This process was repeated for each question.

### Results

The largest proportion of respondents to our surveys (43% in 2010, and 23% in 2009) stated that teamwork made it difficult for them to complete their assignment. The aspects of teamwork that created these difficulties were relatively consistent between cohorts (Table 1). Meeting outside of class and unequal contribution to the workload were among the top three most common reasons given by students in both years of the study, whilst personality clashes and making decisions was more common in the 2010 cohort (Table 1).

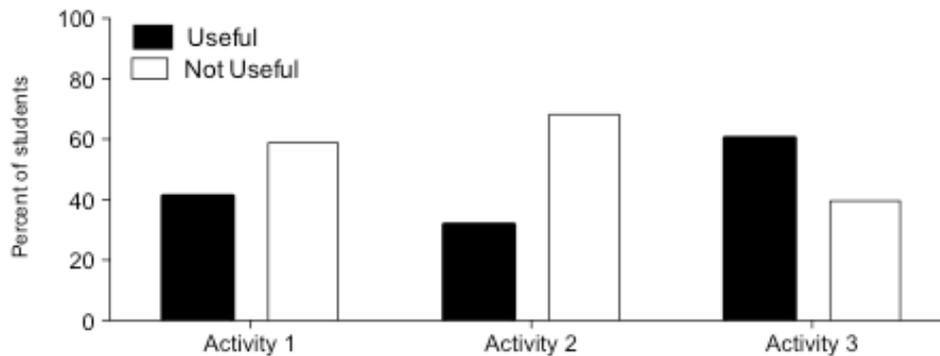
**Table 1: A percentage breakdown of responses that related to “team work” for the question ‘Is there anything that made it difficult for you to complete your assignment?’ collected from the 2010 and 2009 cohorts after completing a team assignment. Please note that the 2010 cohort received training whilst the 2009 cohort did not.**

Category	Percentage	Percentage
	2010 n(responses)=267	2009 n(responses)=394
Meeting outside of class	23.9	13.5
Making decisions and negotiating	16.9	1.0
Unequal contributions	7.2	4.6
Personality clashes	7.6	0.02
Communication problems	3.4	2.2
General	1.7	1.7
No leadership	0.04	0

### Usefulness of team training to students

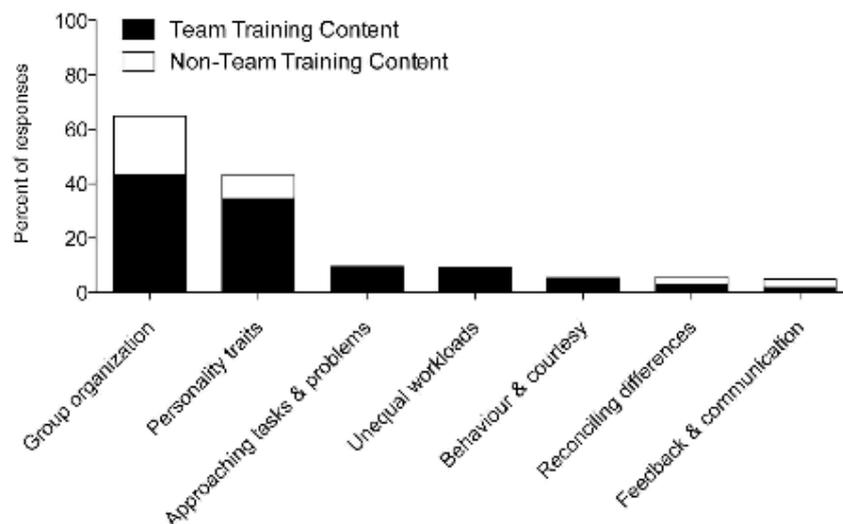
Approximately two-thirds (63%) of the 2010 cohort (all of whom participated in team training) stated that the activity which addressed unequal workloads (Activity 3) was useful, 41% found the team formation activity (Activity 1) useful, and almost one third (30%) of students said that the reconciling differences activity (Activity 2) was useful (Figure 1).

The majority of students that indicated the team training activities were not useful either did not supply a reason or stated that their team functioned well and the activity was not applicable (Table 2). Students that found the activities useful isolated particular elements or benefits gained from the activity (Table 2). For example, almost half of all students that found the reconciling differences activity useful stated this was because it made them consider the opinions of others and approach problems objectively, and 35% of students who found the negotiation of workload activity useful stated that it forced them to reflect on their past work.



**Figure 1: Student responses from the 2010 cohort to the question ‘Were group work activities useful and why?’ categorized as ‘useful’ or ‘not useful’ (n(students)=192). Note: Activity 1 addressed team forming, Activity 2 reconciling differences via effective negotiation, and Activity 3 unequal workloads via peer assessment.**

Whilst fewer than half of the students indicated that the team forming and reconciling differences activities (Activities 1 and 2) were useful, when asked what they would do the next time they had to work in a team to ensure that it functions well, most students described elements of these activities (Figure 2). In particular, student comments focussed upon elements of the training that addressed group organization, personality traits and unequal workloads.



**Figure 2: Student responses from the 2010 cohort to the question ‘Next time you are required to work in a team, suggest one thing you would do to ensure the team worked well’ categorized into themes and divided depending on whether the described behaviour was addressed by team training (black) or not (white).**

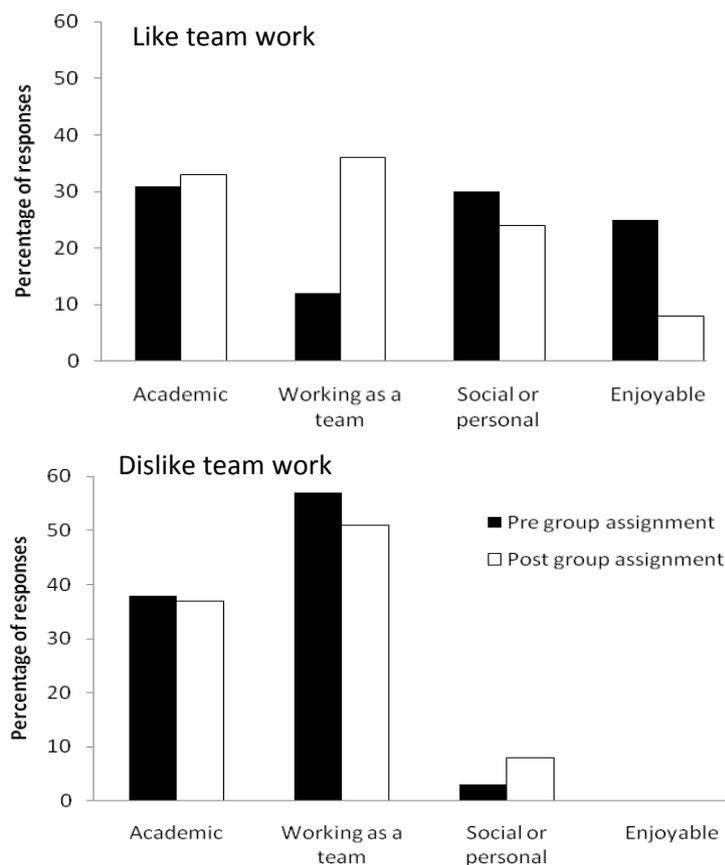
**Table 2: A categorical breakdown of student justifications of the question “Were groupwork activities useful and why?” collected from the 2010 cohort after completing the group assignment. Each activity is presented separately.**

YES, ACTIVITY WAS USEFUL because...		NO, ACTIVITY WAS NOT USEFUL because...	
Category	Percentage (%)	Category	Percentage (%)
<i>Activity 1: Group organisation, personality types and role allocation</i>			
	<i>n(responses)=79</i>		<i>n(responses)=109</i>
It assisted in distributing tasks and roles	27.8	No specific reason	66.1
No specific reason	25.0	It was common sense or a waste of time	20.2
It provided an icebreaker, learned about team mates	24.0	It was not applicable to our group	11.9
It gave guidelines on appropriate team behaviour	17.7	Information does not change bad behaviour	1.8
It gave opportunities to listen to everyone	2.5		
<i>Activity 2: Reconciling differences via effective negotiation</i>			
	<i>n(responses)=66</i>		<i>n(responses)=130</i>
We considered others and approach problems objectively	46.9	No specific reason	51.5
No specific reason	22.7	It was not applicable to our group	28.4
The techniques learned aided in future decision making	19.7	It was common sense or a waste of time	20.0
It was enjoyable, clever, or fun	10.6		
<i>Activity 3: Unequal workloads using peer assessment</i>			
	<i>n(responses)=128</i>		<i>n(responses)=74</i>
It encouraged us to reflect on past work and behaviour	35.2	No specific reason	56.7
No specific reason	22.7	It was not applicable to our group	25.7
Helped with organising remaining tasks	19.5	Negotiating contributions was difficult	9.4
It improved group awareness, was a wake-up call	15.6	Negotiating contributions caused tension or conflict	5.4
Helped learn about perception of others in group	4.6		

### Impact of team training on student attitudes towards team work

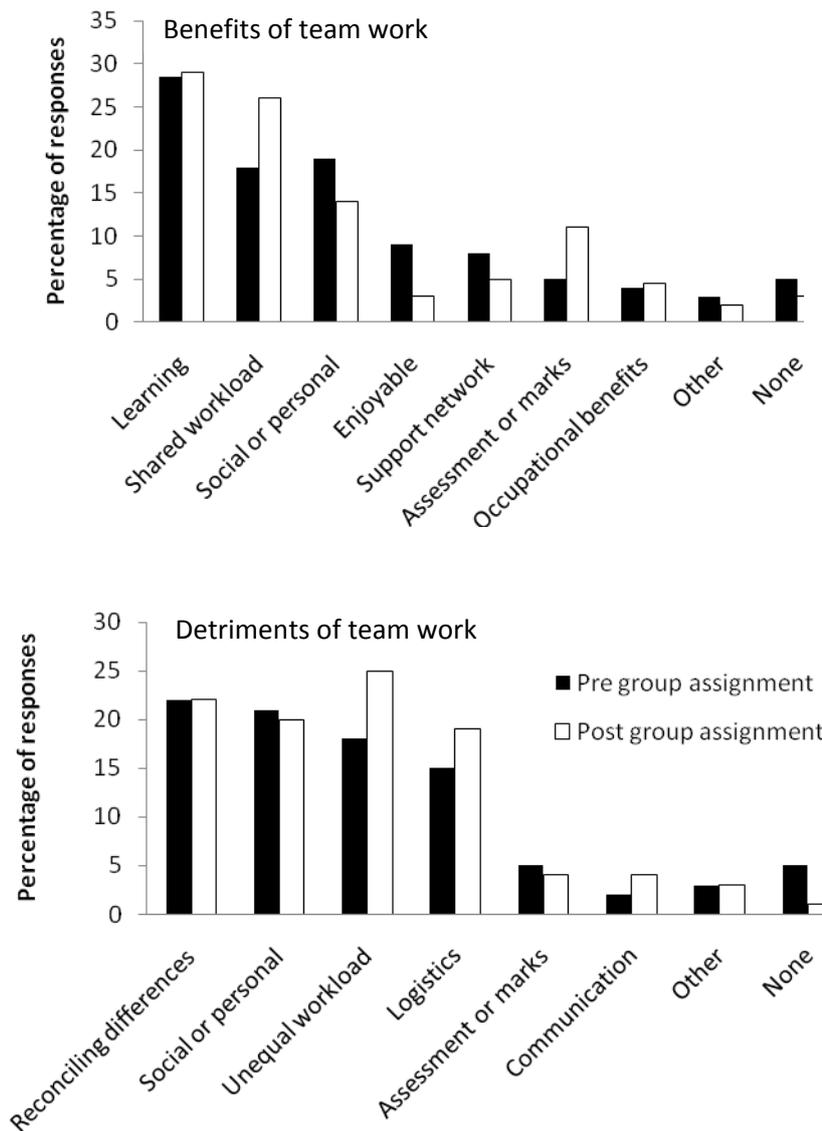
The majority of students in 2010 expressed a positive attitude to team work both before and after the team training activities/assignment. The proportion of students with a positive attitude decreased from 68% to 59% following completion of the assignment. When asked to provide reasons as to why they liked team work, students identified the academic and social/personal benefits of team work as important in both pre- and post- surveys. There was an increased emphasis on, and a shift in the types of, reasons related to working as a team after completing the group assignment, along with a decrease in enjoyment being cited as a reason (Figure 3). The types of reasons students gave that came under the category of “working as a team” also shifted to a more pragmatic emphasis following the group assignment. For example, prior to the assignment this category included collaborating and interacting, support network and help from others and getting to know other people as reasons for liking team work. Following the assignment reasons focussed on shared workload being more efficient, achieving common goals and learning team skills.

Students that disliked team work gave similar reasons both before and after completing the group assignment. Reasons provided for disliking team work focussed on problems associated with working in a team, or ideas that team activities detract from one’s own academic performance (Figure 3).



**Figure 3: Student qualifiers to the question ‘Why do you like/dislike team work?’ from the 2010 cohort (n(students)=192). Percentages are calculated on the number of responses (n(responses) for like = 368; n(responses) for dislike = 180).**

Independent of whether students liked or disliked team work, we asked them in both pre- and post- surveys to identify the benefits and detriments of working in a team. The benefits identified by students changed following completion of the assignment and team training. The largest proportion of students stated elements of learning as a benefit before and after training (52% and 50%), with shifts from social and enjoyment elements to more functional elements such as shared workload and assessment following training (Figure 4). Mirroring reasons for disliking teamwork, attitudes to the overall detriments of teamwork remained relatively constant before and after the assignment, with problems of unequal workloads the only theme that increased considerably following completion of the assignment (Figure 4).



**Figure 4: Percentage of student responses in 2010 to the questions ‘What are the benefits of team work?’ and ‘What are the detriments of team work?’ categorized by the most common themes (n(students)=192). Data were collected both pre and post the group assignment and team training.**

## Discussion

### Difficulties with teamwork and suggested foci for team training

The types of difficulties with team work experienced by students in our study match well with existing literature, suggesting that these may be ubiquitous across institutions. Numerous authors have shown that explicit training is a useful way to prepare students for some aspects of team work (Bolton, 1999; Nazzaro & Strazzabosco, 2003; Oakley *et al.*, 2004), but it is not possible to provide training that prepares students for all potential difficulties they will face. In order to maximise benefits of any type of training, it is important to identify and focus on the most common issues.

In previous studies, up to a third of reported difficulties with team work centred on unequal workloads (Bourner *et al.*, 2001; Payne & Monk-Turner, 2006), and considerable difficulties were reported with communication and coming to a consensus (Bourner *et al.*, 2001; Li & Campbell, 2008). These problems have been reported at numerous levels within tertiary education (Bourner *et al.*, 2001; Payne & Monk-Turner, 2006; Prichard *et al.*, 2006; Li & Campbell, 2008), with negative team experiences resulting in many students having poor attitudes towards future team projects (Payne & Monk-Turner, 2006); a poor outcome for a student entering the workplace. Issues of unequal workload, coming to a consensus and communication are a good place to start for anyone considering implementing team training for university students, and are what we focussed our team training activities upon.

A study by Prichard *et al.* (2006) that compared trained and untrained student groups reported that fewer students in trained groups have difficulties with unequal workloads compared to the students in untrained groups. Bolton (Bolton, 1999) suggested that by providing methods for negotiation and dealing with conflict, and by addressing conflict within class (e.g., coming to a consensus) communication could be improved. To help achieve this Bolton recommended provision of a solid list of expectations for team members, a solid introduction to team work, and guidance for students through forming a “charter” that states what behaviour members can use to improve equality of contribution. Training activities employed in our study were based upon Bolton’s suggestions. The training deployed provided students with a framework for setting standards and reporting problems around unequal workloads, as well as techniques for more efficient communication and negotiation among team members (see <http://www.biology.uq.edu.au/staff/louise-kuchel>).

The top three difficulties identified by students in our study largely agree with those upon which our training activities focussed, but the issues related to communication were encompassed by the broader issue of organisation and logistics. Organisation and logistics accounted for the largest proportion of difficulties reported by students over two consecutive years. Our study differs from most others in that the students involved were in their first semester of their first year at university, which is well known as a time of enormous transition for students (Krause *et al.*, 2005). The majority of students in our study entered university directly from highschool where classes and year cohorts are small relative to university courses (e.g., 30 to 200 students compared with 600 to 1200 at university). As such there is a substantial shift in the organisational and logistical requirements to, for example, meet outside of class. Our results and experience suggest that guidance on group organisation and logistics (e.g., arranging meeting times outside of class, providing multiple contact details, deciding on a common mode of contact outside of class, etc) may be of higher priority for students in their first year of university than providing strategies for improving communication skills. Afterall, if they have no forum by which to communicate, any communication skills they have will be ineffective.

Team training in our study addressed only some aspects of group organization and meeting outside of class. It did not address how to manage personality clashes, which although minimal in 2009, was more common in 2010. This raises the question about whether we should provide explicit support or training on these topics. More explicit guidance or tips for organization (as suggested in (Jones, 2006)) can fairly easily be incorporated into existing training activities without using much time, and is something we are attempting in 2011. Managing or resolving personality clashes however, requires much more time and resources and is likely to be an unrealistic goal in most large university courses where it is not a core content of the course. Topics such as this may be incorporated into follow-on activities should team training be extended beyond a single course or year in a degree program.

Whilst training leads to an improvement in team function, it will not necessarily lead to the disappearance of common problems. We found that the same problems emerged in both years of our study despite one cohort receiving training and the other not. This suggests that difficulties will always emerge for students, some students may not respond to training, and/or the training activities have resulted in students being more aware that problems exist. Training simply aims to introduce students to techniques for dealing with common difficulties in an attempt to prepare them for future experiences. So teachers planning to implement training should expect the persistence of some difficulties for students with teamwork.

### **Team training was useful to many students**

Integrating explicit training about team work into a large first year biology course is novel, and to our knowledge has not previously been tried or evaluated. Our results suggest that students used this training program, though some elements and styles of training were more useful to students than others.

The majority of students in 2010 (63%) reported that training on how to address unequal workloads (Activity 3) was useful, despite continuing to describe it as a problem upon completion of the assignment. When asked what they would do next time to ensure their team functions well, many students identified elements of all three activities that addressed unequal workloads. Pritchard *et al.* (2006) demonstrated that training which addressed unequal workloads can lead to reduced prevalence of 'hitchhikers'. Further replication of our study will help to determine whether, whilst useful, our training activities reduce the prevalence of unequal workloads reported by students. The persistence of reporting unequal workloads despite training may also reflect an increased awareness by students of workload issues as a result of team training activities.

Whilst fewer than half of the students indicated that the team forming and reconciling differences activities were useful (Activity 1 = 41% and Activity 2 = 30%), when asked what they would do the next time they had to work in a team to ensure that it functions well, approximately 80% of student responses described elements of these two activities. In particular, student comments focussed upon group organization and personality traits (i.e., getting to know one another). This apparent contradiction in findings may have several explanations. For example, students may enter university having already acquired these skills/knowledge, or the training activities may have made them subconsciously more aware of the importance of these skills/knowledge.

There is support for team training increasing student awareness in the literature. For example, Holton (2001) found that some team members reported that students applied team skills they had learned in various contexts, and that they were consciously trying to modify

their behaviour to become better team members. In another study, students were also asked what they would do differently next time and reported a similar list of activities including better division of labour (59%), more planning (59%), better time management (52%) and more group meetings (48%) (Bournier et al 2001). It is well known that once a behaviour or way of thinking has been learned and incorporated into normal activity and thinking behaviour, the person is often unaware or unconscious of where or when that behaviour was learned. Hence the apparent contradiction in our results could be a consequence of students having incorporated the associated behaviours into their group interactions. This likelihood is also reflected by the fact that 12 to 28% of students who reported activities 1 and 2 as not useful said that it was because it did not apply to their group, and the majority gave no reason. Hence, these data suggest that these percentages of students that cited activities 1 and 2 as not useful are underestimates.

Students provided a range of reasons for why they found the training activities useful. Activities we used in this study incorporated both role-play (Activity 2) and reflective (Activity 3) methods. Using role-plays to teach conflict resolution is a widely used strategy (Alexander and Boud 2001; Oakley et al 2004;) that allows students to enact difficult situations and to empathise with different personalities (Alexander and Boud, 2001). Reflection activities throughout team assignments are also reported to be good for improving student attitudes to group problem solving and as personal wake-up calls (Heller and Hollabaugh 1992; Towns 1998; Oakley et al 2004; Nazzaro and Strazzabosco, 2003). Reflection is an important educational strategy as, indicated by students in our study, which is requires time and is often neglected in content heavy courses.

The range of reasons provided by students reflects the diversity of students and student backgrounds within the course. Diversity amongst people is well known to increase the number of different ideas and perspectives within groups which is a positive for creativity (Shaw 2004), however it has also been shown that too much diversity can be detrimental with students unable to communicate effectively and see situations in similar ways or resolve conflicts (Shaw 2004; Winter et al 2008). Winter et al 2008 investigated the effect of diversity on team function across different business majors and found that mixed groups were less likely to voice their ideas. Based on these observations they suggest that in order to get the most out of diverse groups, a training intervention may be necessary. It is possible that the diversity in our course is such that the students valued the training because it helped overcome those problems, while not being so diverse that they are not able to see the assignment in a similar way with assistance, they have all chosen to study biology after all.

Many scientists might consider the positive impact of these team training activities to be insubstantial with only one- to two-thirds of the students saying they were useful. Given the wide diversity in background, culture and programs of students in our course, and the likely underestimate in the reported usefulness of activities by students, we consider this conservative result to be very significant, and at the least, deserving of more attention. Many of the students who reported no difficulties with team work, or who said they did not use the activities because their team functioned well, undoubtedly used some of the techniques from the team training activities without being aware of it. Presumably students who did not encounter problems in this course will be better equipped to navigate difficulties they may encounter in future team projects.

#### **Attitudes to group work**

Completing this group work assignment alongside training resulted in a change in reasons for student attitudes to team work. The nature of this change differed between students with

positive and negative attitudes overall. Students that reported liking team work moved from citing reasons of friendship and support networks to more functional aspects of shared workload and learning team skills. This pattern very much reflects the transition of student experiences throughout their first semester of university, with the emphasis on meeting new people and making friends in the initial, to the emphasis on assessment and grades towards the end of the semester once friends and social networks have been established.

Considerable research shows that negative attitudes rarely shift as a result of a single experience and are often slow to shift. Given the prevalence of team work required in the workplace, it is of benefit for students to acquire a positive attitude towards working as part of a team. Consequently attempts to shift students perceptions of team work are of long term value to the student. It may require multiple positive experiences to achieve a shift from negative to positive attitude about working in a team, which would be unlikely to be detected in a study such as this one. When considering implementation of a team training activities it is likely to be more immediately beneficial to students to focus on the types of activities above which may, with experience and practice lead to a shift from negative to positive attitudes towards group work through the practice of skills learned.

## Conclusion

The data presented here are amongst the first steps in determining whether it is worth taking time out of first year science courses to explicitly teach team skills. Integrating explicit training about team work into a large first year biology course is novel, and to our knowledge has not previously been tried or evaluated. Our findings suggest that science students have similar difficulties with team work as reported in the literature for other disciplines. Despite encountering difficulties, many students clearly saw that team work was a benefit for learning, social and practical reasons.

Our results indicate that students used the team training program, though some elements and styles of training were more useful to students than others. Team training activities incorporated into normal classes helped (conservatively) 30 to 63% of first year biology students in their first semester of university. Whilst further replication of this study is required to directly assess whether training reduces the difficulties faced by untrained students, we argue that, given the diversity of students in this large course, making a positive impact on one- to two-thirds of students is significant. Some of the positive impacts from these activities may not have been detected by this study, but may be felt by students in future team projects as they apply the techniques learned. We expect that further tailoring of the team training activities to better align with student responses to this study will increase this outcome.

Our training was designed around the three seemingly ubiquitous problems of unequal workloads, communication and negotiation, identified by both previous research and our own study. Our study suggests that guidance on organisational and logistical aspects of working in a team is particularly important for students in their first semester of university. This is an aspect not previously identified by studies on team training. This suggestion is based on data from our study and aims to assist students in their transition from small highschool or workplace contexts to large university classes.

Further research is required to determine whether team training reduces the difficulties encountered by students in team work, and to elucidate reasons why students report certain activities as not useful. Based on our data and other observations, we have made some small adjustments to the team training activities to be run in 2011. In the first activity we have

included guidance on how students can better organise their team, including a page where students must decide on a mode of communication, exchange contact details and agree on a time outside of class to meet on a weekly basis. We have reduced activity two to a single role play, which is a scenario based on their assignment, rather than on an unrelated scenario. We plan to continue this study in the coming years and if possible to expand it to include large classes at other universities in an attempt to develop more statistically robust conclusions in answer to the question posed in the title of this paper.

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