

**Effective implementation of group work in higher education**

Co-operative learning (also referred to as collaborative learning or group work) has been hailed as ‘one of the greatest success stories in the history of educational innovation’ (Slavin, 1996). This statement reflects the positive findings of co-operative learning on student achievements at school. Three main reasons for adopting group work are commonly cited: (1) group or collaborative learning is an effective form of learning (Slavin, 1996); (2) group work promotes teamwork skills that employers require and value (Cooper & Lybrand, 1998) and (3) efficiency in the use of staff time when student:staff ratios are falling (Sharp, 2006). In addition, group learning is considered to encourage life-long learning and may be better suited to some students (e.g., women and minority groups) than more individualistic styles of learning (Boud, Cohen & Sampson 1999).

Whilst there is evidence in support of the benefits of group work for student learning there are several factors that may impinge negatively on group work. These include cognitive and psychological factors (Cantwell & Andrews, 2002), lack of appropriate student skills (Prichard, Stratford & Bizo, 2006), the quality of the collaborative learning methods (Slavin, 1999), the group management skills of tutors and group assessment. Group assessment procedures are particularly problematic because of the need to assess individuals within a group (Boud et al., 1999).

The simplest method of group assessment involves each student receiving the same mark (Nicolay, 2002). However, there are two potential problems with this method. First, it assumes equal contribution by group members, an assumption that has been shown to be incorrect (Bourner, Hughes & Bourner, 2001; Mills, 2003). Secondly, universities require individual marks for students, for ranking purposes. To address these concerns numerous methods have been reported for deriving individual marks from a group assignment. Lejk, Wyvill and Farrow (1996) outlined no fewer than nine different methods for obtaining individual marks from group work and the number continues to increase (Bastick, 1999; Sharp, 2006). Currently, however, there is no consensus as to whether one method is superior to another.

Given that group work has both benefits and drawbacks, what is the student’s experience and satisfaction with group work projects in higher education? A number of studies have been undertaken to address this question in relation to specific projects and, generally, they have indicated a high level of satisfaction (Gatfield, 1999; Bourner et al., 2001; Barfield, 2003; Mills, 2003; Gupta, 2004). However, some studies have reported students making negative comments about group work. A major reason for negative comments is the issue of ‘passengers’ (i.e. poor contributors) (Bourner et al., 2001) or ‘free riders’ (Boud, 2001).

In 2002, Cantwell and Andrews developed a 30-item questionnaire (Feelings Towards Group Work) in which three main factors were identified: preference for individual learning, preference for group learning and discomfort with group learning. We considered Cantwell and Andrew’s questionnaire an ideal instrument for the current

study as it measures attitudes towards group work *per se* rather than student's experience of specific group projects, as previously reported.

### *Research aims*

The present study was initiated by negative verbal reports from students about their group work experience within the Faculty of Science (University of Sydney, 2002). This was of concern since it indicated students were not benefiting from the positive aspects of collaborative learning. The main aim of the study was to investigate whether students preferred individual work to group work as implied by the Academic Board Review. Additionally, we were interested in determining whether different methods of group assessment would significantly affect students' attitudes to group work.

### *Context of the study*

Information technology and pharmacology students from within the Faculty of Science were invited to participate in the study. These two disciplines were chosen as they used different group assessment methods (see *Group assessment procedures*). The Feelings Towards Group Work questionnaire was administered to both cohorts to measure students' attitudes towards group work *per se*. To determine students' attitudes towards the different assessment methods, two 10-item questionnaires were administered: one for information technology (Attitudes Towards Group Work Assessment), the second for pharmacology (Attitudes Towards Peer Evaluation).

*Pharmacology.* Students were 2nd year (2nd semester) science students who had chosen to study pharmacology as a part of their undergraduate degree. Most, but not all, had completed a similar course in pharmacology in 1st semester. 72% of the respondents were female at Time 1 which reflects the proportion of females in the cohort. At Time 2, 82% of the respondents were female.

Students were allowed to self-select the members of their group. Groups of 4 - 6 students were advised but in some instances groups of 8 were formed. Students remained in the same group throughout semester. Five compulsory group work sessions were scheduled: (1) two practicals with an assessable group laboratory report, (2) two computer-based sessions (no assessment) and (3) one workshop involving a poster presentation (assessable). The group assessment procedure involved tutor assessment of the assignment (product) and peer (but not self) evaluation of process.

The intention was that evaluations were to be kept confidential, however, many students chose and/or thought they were required to hand their evaluation to the student handing in the group report. Group work assessment accounted for 26% of the final mark awarded (semester work + examination).

*Information technology.* Students were 3rd year information technology students who had chosen to undertake an information systems project as a part of their undergraduate degree. These students would have been involved in some group exercises in 2nd year units and 1st semester 3rd year units. The gender ratio for this group was essentially 50:50, as was the ratio of the respondents (52% female at both Time 1 and Time 2).

Students were invited to find their own projects and to form their own groups: groups of 6 were advised. The 'client' was a person outside the School of Information Technology and usually outside the university thus providing authenticity to the project. 40% of the assessment was for individual work and 60% for collaborative tasks: both

were tutor assessed. All students in each group received the same mark for the collaborative (group) work.

## **Method of investigation**

### *Participants and design*

The study involved two phases of data collection - the first held in week 1 of semester 2 and the second held in the final teaching week of the same semester. Participation involved completion of the aforementioned questionnaires (see *Context of the study*) – optimally by the same respondents at both data collection phases (Time 1 and 2). All potential participants were invited to participate in both phases of data collection and were informed that participation would involve completion of a survey at two points during the semester. In the initial phase (Time 1) 118 pharmacology students, out of a cohort of 160 enrolled students, and 119 information technology students, out of 136 enrolled students, participated. A smaller number of students participated in the Time 2 phase of data collection - 65 pharmacology and 103 information technology students took part. Importantly, the samples voluntarily participating at Time 2 were taught and evaluated in the same way as those students choosing not to participate and thus provide a representative sample.

### *Group assessment procedures*

For pharmacology, the group assessment procedure involved tutor assessment of the assignment and peer evaluation of process. The product (lab report or presentation) was assessed by staff using criteria given to students before completion of the group assignment. Individual marks were derived from the peer evaluation mark. The method used was an adaptation of that used by Bastick (1999) and was based on five performance criteria (reliability, preparation and participation, completion of a given task, contribution to group discussion and provision of feedback). The score for each criterion was calculated by multiplying the number in the group less one, by 20. Students were asked to distribute the score for each criterion between group members according to their performance. The average percentage of the total scores was then used to calculate individual marks based on the mark received for the product. This meant that some students received a mark that was higher than the assignment mark, others a lower mark.

For information technology, the product was assessed by staff using criteria given to students before completion of the group assignment and there was no peer evaluation. All students in a group received the same mark.

### *Measures*

*Feelings Towards Group Work Questionnaire.* The original 30-item Feelings Towards Group Work questionnaire developed by Cantwell and Andrews (2002) was not sufficiently reliable for the present sample, and the reliability analyses resulted in the deletion of three of the original items in order to achieve acceptable levels of reliability for the current study - Cronbach's alpha for the Preference for Individual Work (I) subscale = .82; Preference for Group Work (G) subscale = .53; and Discomfort in Group Work (D) subscale = .64 (White, Lloyd, Stewart & Kennedy, 2005). Each item in a subscale was rated on a five-point Likert scale item so that a negative response is 1 or 2, neutral is 3 and positive is 4 or 5. The neutral mid-point of the Individual and

Group Work Preference subscales (seven items) is a score of 21, the neutral mid-point for the Discomfort in Group subscale (four items) is 12.

*Attitudes Towards Peer Evaluation and Attitudes Towards Group Work Assessment Questionnaire.* Two questionnaires were developed by White et al., (2005) for the current investigation. The Attitudes Towards Peer Evaluation scale was developed to measure students' perceptions of the peer assessment process. The instructions for pharmacology students were as follows:

This questionnaire contains a number of statements concerning your thoughts about the process of peer evaluation and its use to calculate individual marks in Pharmacology.

The Attitudes Towards Group Work Assessment scale was developed to measure students' perceptions of the group assessment process. The instructions for information technology students were as follows:

This questionnaire contains a number of statements concerning your thoughts about the process of evaluating group work in Information Technology.

These newly developed scales consisted of 10-items, where each item is rated on a five point Likert scale, where a total score close to 10 would be considered a *negative* attitude toward group assessment, a score close to 30 would be considered *neutral*, and a score close to 50 would be considered *positive*. Both scales showed high internal reliability – Cronbach's alpha ranged from .83 to .88 for the Attitudes Towards Peer Evaluation; and from .70 to .87 for the Attitudes Towards Group Work Assessment. Refer to White et al., (2005) for full versions of these scales.

### *Procedure*

At Time 1 all pharmacology students were administered the Feelings Towards Group Work and Attitudes Towards Peer Evaluation in the lecture theatre whilst the information technology students were administered the Feelings Towards Group Work and Attitudes Towards Group Work Assessment in groups of 20 – 30 in tutorial rooms. Thirteen weeks later, after each student cohort had completed their group work task, the same set of questionnaires were administered to them at Time 2. In each phase, questionnaire administration was counterbalanced to guard against order effects. All participants were given approximately 40 minutes to complete the questionnaires.

## **Research findings of the study**

### *Analyses of correlations between the measures*

Prior to testing the main research questions, we adopted the standard approach to missing data that results when not every participant provides complete responses to all scales. This approach involves list-wise deletion of missing values in independent t-test analyses and correlational analyses. As a consequence, the *Ns* reported vary according to the number of complete data sets provided and subject attrition that is a common feature of field research that involves a 'follow-up' design.

A correlational analysis investigating the relationship between the group work measures was conducted on the total sample of pharmacology and information technology students (*N* = 140) at Time 2, after they had conducted their respective

group work projects. As expected there was a significant negative correlation ( $r = -0.18$ ,  $p < .05$ ) between the preference for individual work (I) subscale and the preference for group work (G) subscales; a negative correlation ( $r = -0.22$ ,  $p < .05$ ) between the (G) and discomfort in group work (D) subscales and positive correlation ( $r = 0.21$ ,  $p < .05$ ) between the (I) and (D) subscales. Importantly, for convergent validity, the peer evaluation/group assessment questionnaires were negatively correlated ( $r = -0.47$ ,  $p < .01$ ) with the (I) subscale and positively correlated ( $r = 0.18$ ,  $p < .05$ ) with the (G) subscale. In other words, students who reported favourable attitudes towards group assessment also reported favourable attitudes towards group work in general.

*Ratings data: Attitudes towards group work for the combined sample*

The main aim of the study was to investigate whether students preferred individual work to group work as implied by the Academic Board Review. Looking at the survey responses broadly, student attitudes towards individual work were less favourable than their reported attitudes towards group work. At Time 1 or base-line, before any Semester 2 group work had taken place, the mean preference for individual work ( $M = 19.44$ ,  $SD = 5.21$ ) was significantly lower than the mean preference for group work ( $M = 26.73$   $SD = 3.15$ ), where  $t(367) = 17.90$ ,  $p < .001$ , for the combined sample of pharmacology and information technology students ( $N=224$ ). Importantly, this significant difference persisted at Time 2, after the group work projects had been completed, where the mean preference for individual work ( $M = 19.22$   $SD = 5.46$ ) was significantly lower than the mean preference for group work ( $M = 27.13$   $SD = 3.24$ ), where  $t(238) = 15.19$ ,  $p < .001$ , for the combined sample of pharmacology and information technology students ( $N=151$ ).

*Ratings data: Within and between differences in pharmacology and information technology samples' attitudes towards group work*

A more detailed analysis was conducted to see if these differences were found *within* the two cohorts of students. Table 7.1 reveals that for pharmacology students at Time 1 the mean preference for individual work was significantly lower than the mean preference for group work, where  $t(152) = 9.45$ ,  $p < .001$ . Similarly, for the information technology students, the mean preference for individual work was significantly lower than the mean preference for group work, where  $t(216) = 16.53$ ,  $p < .001$ . Overall, these analyses reveal that there are more favourable preferences for group work than individual work, contrary to the Academic Board Review's concerns.

An independent t-test analysis was also conducted to see whether there were differences *between* the two cohorts of students. At Time 1, the pharmacology students mean preference for individual work was significantly greater than information technology, where  $t(201) = 2.71$ ,  $p = .007$ . Additionally, at Time 1, the pharmacology students mean preference for group work was significantly less than information technology, where  $t(201) = 2.41$ ,  $p = .017$ . At Time 2 there were no significant differences between the two cohort's preferences for individual work or group work.

Table 7.1. Means and standard deviations of students' attitudes at Time 1 and 2

	Time 1		Time 2	
	M	SD	M	SD
<b>Pharmacology</b>				
• Individual work preference	20.41	5.77	18.55	5.52
• Group work preference	26.21	2.70	26.87	3.05
• Discomfort in group	9.26	2.45	8.09	2.78
• Attitudes towards peer evaluation questionnaire	30.17	6.65	30.06	8.03
<b>Information Technology</b>				
• Individual work preference	18.53	4.45	19.62	5.41
• Group work preference	27.20	3.46	27.28	3.35
• Discomfort in group	8.79	2.83	8.40	2.70
• Attitudes towards group work assessment	30.20	4.67	30.34	6.95

*Ratings data: Changes in attitudes towards group work for the pharmacology and information technology samples between Time 1 and 2*

In order to test whether there were changes in student attitudes between Time 1 and 2, an independent samples t-test was conducted. As reported in Table 7.1, there was a significant decrease in pharmacology students' mean preference for individual work [ $t(161) = 1.99, p < .05$ ] between Time 1 and 2; in contrast, information technology students' preference for individual work remained the same [ $t(207) = 2.8, p > .05$ ] between Time 1 and 2; the mean preference for group work remained the same for both Pharmacology [ $t(160) = 2.81, p > .05$ ] and information technology students [ $t(211) = 2.82, p > .05$ ] between time 1 and 2; and the mean reported discomfort in groups decreased significantly for the pharmacology sample [ $t(164) = 2.81, p < .05$ ] but not for the information technology sample [ $t(211) = 2.81, p > .05$ ] between Time 1 and 2.

A stronger dependent samples t-test was also conducted on the data of the smaller sample of participants who participated at both Time 1 and 2. This analysis, which we have reported previously (White et al., 2005), revealed one additional significant finding – the mean preference for group work increased significantly for the pharmacology sample [ $t(42) = 2.60, p < .05$ ]. Overall, students' responses were more favourable towards group learning and less favourable of individual work in Time 2 than in Time 1 — a small improvement, but a positive result.

*Ratings data: Changes in attitudes towards group assessment for the pharmacology and information technology samples between Time 1 and 2*

Students' perceptions toward two different models of assessment - peer evaluation and group assessment - were also analysed. Table 7.1 reveals that student attitudes towards peer evaluation and group assessment did not change over time, remaining *neutral* from

Time 1 to Time 2. *In fact*, neither model stands out as particularly positive or negative for the students. Before making any definite conclusions, however, further analysis was conducted on the open-ended data.

*Open-ended data: Evaluating the content of student feedback about their group work experience*

In addition to the rating scale data, open-ended comments on group work were also collected. Approximately 1 in 3 students provided comments about their group work experiences. Of this smaller cohort, 80% expressed negative attitudes. Tables 7.2 and 7.3 reveal the breakdown of these comments at both Time 1 and 2.

Table 7.2. Information technology students' comments about the process of group work at Time 1 and 2

Information Technology student open-ended comments	Time 1 (n = 112)	Time 2 (n = 99)	Category
Free riders still receive the same mark as the group/ Does not recognise variation in individual effort/quality	16	11	Negative
Need individual OR individual and group mark	7	4	Negative
Other negative comments (idiosyncratic responses)	8	5	Negative
Negative comment about group evaluation	5	0	Negative
Other comments	7	1	Neutral
Enjoyed group work/criteria was clear	2	6	Positive
Satisfactory/reasonable/neutral	0	3	Neutral
No comment provided	67	69	None

Note: At Time 1 comments provided by 26 females and 19 males. At Time 2 comments provided by 16 females and 14 males.

Table 7.2 reveals that the majority of concerns expressed by information technology students revolved around the fact that there was a single overall group mark, and that this group assessment strategy was not sensitive enough when recognising variations in individual effort. These negative comments relating to an overall group mark being allocated to every individual in the groups persisted at Time 2. Interestingly, this cohort of information technology students also expressed some neutral and positive comments about their group work experience.

The profile of open-ended comments provided by the pharmacology students, where a peer evaluation strategy was adopted, was quite different to that of the information technology students. Specifically, Table 7.3 revealed that pharmacology students were less concerned about 'free riders' receiving the same mark as those students that put

effort into the group project, and more concerned that the peer evaluation process for the allocation of marks was not anonymous. The lack of anonymity and confidentiality appeared to create further biases (i.e., reciprocity effects, pressures from friends within the group etc) in the allocation of marks to fellow group members. The proportion of concerns relating to this issue persisted between Time 1 and 2.

Table 7.3: Pharmacology students' comments about the process of group work at Time 1 and 2

Pharmacology students open-ended comments	Time 1 ( <i>n</i> = 112)	Time 2 ( <i>n</i> = 57)	Category
Lack of anonymity and confidentiality led to – people expecting reciprocal marks/giving unfair marks to friends/ pressure to marks others in a certain way	20	8	Negative
Don't like peer evaluation	1	0	Negative
Not enough range in marking	1	0	Negative
Too confusing/complicated	0	3	Negative
Other negative comments (idiosyncratic responses)	6	2	Negative
Positive comments about peer evaluation	3	1	Positive
No comment provided (none)	81	43	None

Note: At Time 1 comments provided by 22 females and 9 males; At Time 2 comments provided by 12 females and 2 males.

### **Discussion: The implications of these research findings for improving teaching and learning**

A continuing challenge for educators using group work is to ensure that it remains a positive learning experience for students. Group work is an important teaching strategy within the science curriculum as it can facilitate learning through knowledge acquisition as well as developing generic graduate attributes, such as the ability to work as a team (Elliot & Higgins, 2005). The science students surveyed in this study were found to have a greater preference for group work than individual work, reinforcing the results of previous research suggesting that group work is generally a positive experience for students (Gatfield, 1999; Bournier et al, 2001; Barfield, 2003; Mills, 2003; Gupta 2004). The factor(s) accounting for the small but significant difference between the two groups, with respect to their attitude towards group work (pharmacology students mean preference for group work being lower at both time points) is unknown. However, the two cohorts did differ with respect to age and gender ratio. Pharmacology students were 2nd year undergraduates and 70% were female. Information technology students were 3rd year undergraduates and the gender ratio was 50:50. A further uncontrolled variable was the recruitment environment. Pharmacology students were surveyed as one group in the lecture theatre whereas information



technology students were surveyed in groups of 20 - 30 in their tutorial rooms. This factor may explain the higher drop-out rate (see section 2.1) for the pharmacology cohort. Together these uncontrolled factors may contribute to the difference between the two groups.

Attitudes towards group work assessment, irrespective of method, were found to be *neutral*. This *neutral* attitude may explain why the method of assessment appeared to have little impact on students' perceptions of group. The observation that peer evaluation had little impact seems at variance with the general acceptance of the value of peer evaluation in enhancing group work (Lejk, Wyvill & Farrow, 1996; Lejk & Wyvill, 2001) and may reflect the concerns that students had about the type and/or how the peer evaluation method was implemented, in our study. Interestingly, a dependent samples *t-test* indicated that students' attitudes towards group work in pharmacology did improve slightly over the course of the study but this may have been due to other unknown factors and not peer evaluation.

Whilst peer evaluation has been adopted as a means of reducing the 'free rider' effect and improving the fairness of group assessment, little attention has been given to other factors that may improve students' feelings towards group work. The finding by Cantwell and Andrews (2002) that students who expressed a preference for individual work also reported higher levels of social anxiety, clearly needs to be factored in when managing group work projects. Our findings of a positive correlation between the preference for individual work (I) and discomfort in group-work (D) subscale confirms their finding.

The open-ended comments provided valuable information for directing educators on how to improve group work management and assessment strategies. Firstly, with regard to group assessment, Table 7.2 reveals that information technology students reported problems of inequity when, irrespective of their contribution to the group work, the same mark was awarded to each student. In contrast, students from pharmacology did not comment on inequity (Table 7.3). Thus, peer evaluation appears to reduce students' concerns about the 'free rider' (Boud, 2001) or 'passenger' (Bourner et al., (2001) within the group. However, our study indicated that lack of anonymity and confidentiality impacts negatively on the peer evaluation process (see Table 7.3). To prevent this, we now ask students to submit their peer evaluations on-line via WebCT to ensure anonymity.

One strategy for promoting group function is to incorporate an individual student component within a group work project. We have successfully adopted this strategy in PSYC3012 - Social Psychology. Together, the group collects and analyses data and writes a research report, lacking a discussion. Each student then writes a discussion that is assessed individually. Allowing students the freedom to express their individual knowledge and ideas independently of other group members may be the necessary balance needed for optimal group functioning as has been indicated in the research literature on the importance of group goals and individual accountability (Slavin, 1999). Notably, the information technology project included a significant individual component (worth 40%) that may have contributed favourably to their preference for group work.

Whilst the ratings data showed that students had a favourable attitude towards group work, there were very few positive open-ended comments about group work. Group work is a unique learning tool, but it only works effectively if tutors have the necessary management skills. Thus, improving group management may increase the number of

openly expressed, positive comments. This could be achieved via the introduction of tutor-training workshops in which the following topics are discussed: i) factors to consider when assigning students to groups; ii) communicating clear objectives and guidelines; iii) skills required by students for successful group work; iv) helping students manage their group responsibilities; and v) making explicit how the group activities help student learning. As a consequence of this study, an introductory tutor-training workshop has been integrated into the first week of the PSYC3017 Social Psychology syllabus.

In conclusion, this study indicated that group work was preferred above individual work irrespective of the method of assessment. These results are encouraging. Additionally, the open-ended comments revealed that peer evaluation eliminates problems associated with the 'free rider' concern of students when only a single group mark is allocated. Improvements in peer assessment procedures and provision of specific tutor training may further increase students' enjoyment of and benefit from group work.