

# Group Work: Does It Work?

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## ABSTRACT

Group-work plays a significant part in all undergraduate courses while working effectively as a member of a group is one of the most important generic skills that students need to develop while at university in preparation for their future working lives. Many stakeholders, however, have reservations regarding group-based assignments, in particular about whether or not individual group members are rewarded appropriately for their contribution to the overall group achievement. The success of group-work is dependent on both extrinsic factors, such as assignment design, management, assessment, etc. as well as intrinsic factors, such as the knowledge, skills, etc. of individual group members.

In this paper the challenges presented by the extrinsic factors that impact on the success of group-based assignments are considered against the background of the of formal summative assessment of group-based assignments on BSc Computing undergraduate courses in the Department of Computing at Canterbury Christ Church University in the United Kingdom. In particular the effectiveness of group-work in terms of improved learning, improved development of non-cognitive skills and assessment validity/reliability are considered.

**Keywords:** Group-work, assessment, fairness, coursework, self-assessment, peer-assessment, reliability

## INTRODUCTION

Group-work skills are one of an important of a set of generic (common) skills that all students need to gain/develop. In the case of most courses, this is particularly important since students' future working lives (Dearing, 1997) will often be collaborative-based (Kidder, 1981). As such, group-based assessment is a highly valid form of assessment. Student performance, learning and higher level cognitive skills are all held to benefit from group-work as long as it increases student engagement with and reflection upon the subject itself. Interpersonal, leadership and organisational skills, as well as self-motivation and self-esteem are typical of the many non-cognitive areas that are held to benefit from group-work (Thorley and Gregory, 1984). Students who work in groups also tend both to be more satisfied with their course and more appreciative of the value of group-based learning (Johnson, D., Johnson, R. and Smith, 1991). Group-work, with its associated peer pressure, can sometimes encourage students, who have not previously done so, to engage with a course. Group-work also allows students to undertake larger more complex/realistic tasks than they could attempt individually, not just as a result of additional manpower but also due to the associated economies of scale and division of labour.

Governments and, of course, employers prize group-working skills. Thus, for example, the employer-led, e-skills UK organisation (licensed by the United Kingdom government as the Sector Skills Council for IT and Telecoms) introduced, amongst others, the IT Management for Business (ITMB) degree course which is currently

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available at twenty United Kingdom based Universities. The development of this course was funded by the United Kingdom government and was designed by leading international IT companies with a view to ensuring that ITMB degree graduates are equipped with the skills, including group-work skills, required by industry (e-skills UK, n.d.).

Professional bodies such as the United Kingdom based British Computer Society (BCS) also recognise the need for group-working skills and as such includes "working with others" in their requirements for accreditation of University and other Higher Education Institution courses (British Computer Society, 2011).

Given the interest of the government, employers and professional bodies it is not surprising that educational establishments are often expected to expose students to group-based activities. For example, in the United Kingdom, the Quality Assurance Agency for Higher Education (QAA) honours degree computing subject benchmark statement states "[each Higher Education Institution] should be expected to be able to show that ... in practical coursework there is an opportunity for students to gain experience of working ... in groups [and] students will adopt a disciplined approach to their tasks [including] the related practical and transferable skills, including relevant approaches to group activity" (Quality Assurance Agency for Higher Education, 2007)

Many of the stakeholders involved in group-based assessment, however, have reservations. The most significant issue (Race, Brown and Smith, 2005) is that students, lecturers and external examiners alike all question whether individual group members are rewarded appropriately based on their individual contribution, in terms of both effort and skill, to group-work.

The success of group-work is dependent on extrinsic factors, such as assignment design, group allocation, management and assessment, as well as intrinsic factors, such as the knowledge, skills, motivation, personalities, experience, etc. of individual group members. These extrinsic factors are considered in this paper against a background of many years of formal summative assessment of group-based assignments on BSc courses in the Department of Computing at Canterbury Christ Church University located in the United Kingdom.

## **DESIGNING GROUP-BASED ASSIGNMENTS**

As with any assignment, group-based assignments must have a well-defined task, must be perceived as an integral part of the course and must match students' skill/ability levels. Additionally, group-based assignments must also match students' group-working skill/ability levels. Furthermore, while individual students must be held accountable for their own actions, a group-based assignment must also necessitate mutual dependence between group members if learning is to be effective. In this way, individual group members feel that they succeed or otherwise as part of a group and not as individuals. The fact that the group as a whole is relying on individuals within it is strong motivationally (Kohn, 1986). Mutual dependence can be achieved, for example, by setting assignments that force group members to divide the work into mutually interdependent parts or that force group members to reach a consensus (Johnson, D., Johnson, R. and Smith, 1991).

Group-based assignments must facilitate a potentially even work load between all members of the group so that every group member has the opportunity to make an equal contribution. One way to achieve this is to design assignments that have clearly identifiable activities which can be easily distributed between group members who must then each individually make a success of their activity in order for the group, as a whole, to succeed. Unfortunately, this approach takes away part of the rationale and learning process of group-work in that the group members themselves do not break the work down into activities.

It should be noted that assignments that allow group members to compete with each other should be avoided since they tend to reduce the benefits of group-based coursework. The popular UK television show "The Apprentice" (British Broadcasting Corporation, n.d.) illustrates this graphically. The participants in this television show take part in competitive group-based activities but never fully embrace working as part of a group because all the participants are also competing against each other for the show's prize which is awarded to an individual not a group.

Finally, designing group-based assignments involves many interrelated factors. These factors are not necessarily mutually exclusive and trades-offs will often be required.

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## **ALLOCATING STUDENTS TO GROUPS FOR GROUP-BASED ASSIGNMENTS**

It must be recognised at the outset that students are often concerned about working with others with whom they are unfamiliar. Students can be randomly assigned to groups thus maximising the groups' heterogeneity (Smith, 1986). Alternatively, lecturers can choose the groups, taking into account various factors, to produce either homogenous groups or, at the other extreme, to spread the various student talents around the groups as evenly as possible (Walvoord, 1986). Some students find either of these approaches rather intimidating (Stock and Stephens, 2008). An alternative, when students are known to each other, is to let them select with whom they want to work. This approach, however, is not a good match with what students will eventually experience in their future careers where they will not normally be allowed to choose with whom they work. Walvoord (1986) suggests yet another option where students express their choice regarding potential group members but that the final allocation is left to the lecturer. The Department of Computing undergraduate course team, however, believes that such an approach could potentially result in some students being disappointed that their choice of group was ignored thus creating problems from the very outset.

In the Department of Computing, group-work on undergraduate database courses first occurs in year two (of the three year programme) by which time the majority of students are reasonably well acquainted with each other and, as such, they choose their own groups. There are, however, always those students that, for various reasons, do not find a group and in these cases lecturer intervention is inevitably required to either parachute them into an existing group or form a new group of such students. In year three the students are much better acquainted with each other, including an awareness of how their fellow students performed in group-work, and generally, during the previous academic year. The result is that students' selection of each other is more considered and consequently groups tend to be much more homogenous, happy and harmonious. For example, hard workers/high achievers will often tend to group together. This results in less, if any, need for course team intervention to form groups, less group problems, more positive student feedback and much less variation in students' perception of their team mates contribution to the group effort.

In general, groups should be neither too large nor too small. Large groups tend to reduce an individual group member's ability to participate actively and provide the opportunity for those who do not want to participate actively to free ride without being noticed. Very small groups, while presenting fewer opportunities to free ride, tend to reduce the benefits of group-based coursework. In the Department of Computing even numbered size groups are generally avoided to reduce the risk of groups being unable to achieve majority decisions in a timely manner and group size is normally set at three so that it is hard for a slacker to hide their lack of effort (Stock and Stephens, 2008).

## **MANAGING GROUP-BASED ASSIGNMENTS**

Lecturers should formally/informally maintain regular contact with groups in order to monitor progress, provide formative feedback, check for (potential) problems and, of course, provide appropriate assistance if required. Groups should be encouraged to plan their work, including task allocation along with planned completion dates. Such planning will inevitably be crude because of student inexperience but this can, to some extent, be mitigated by help from a lecturer. Planning is critical as it allows both lecturers and groups themselves to identify timescale slippage at an early stage.

Some groups may experience problems, including difficulty in allocating tasks fairly, disparity of motivation, work ethic and ability between group members, group members who take control of their group and group members who do not contribute because of their innate quietness or their absence due to illness, etc. Most problems can normally be resolved with little more than minor lecturer intervention in the form of an individual and/or group discussion and

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a little direction (Stock and Stephens, 2008). The major cause of problems, however, is slackers who do not fully contribute to their group by not attending meetings, not delivering their allocated tasks on time (if at all), etc. Students must be made to realise that slacking is not an option that will go un-penalised. Walvoord (1986) suggests that after completion of a piece of group-work each student should submit a confidential report detailing their perception of the group's achievements, effectiveness and problems, along with their perception of their own and their fellow group members' individual role/contribution. This form of both self and peer assessment is employed in the Department of Computing where each student completes a standard confidential "Individual Report" that has become known to students, for obvious reasons, as a "rat sheet"! The system generally works well and reduces a lot of intra group tension because if a group has a slacker the other members know that they have the opportunity to report this and, if substantiated, the slacker's mark, as well as their own, will be adjusted. Walvoord (1986) further suggests that such reports are also produced during the group-work. In this way group members who, by consensus, appear to be slackers realise that their behaviour has been recognised and they thus have an opportunity to change their behavior. This practice is not adopted in the Department of Computing because the course team feels that it could cause discord within groups and additionally undermine the well-recognised confidential nature of the "Individual Report".

If a group is having problems then breaking the group up and distributing its members to other groups should normally be avoided for two reasons. Firstly, the whole point of group-work is that the group succeeds or fails as a whole and dealing with problems in this way does little to foster group-working. Secondly, distributing a problem group's members to other groups may disrupt the receiving group (Walvoord, 1986). In the Department of Computing, group members are not normally distributed to other groups if problems occur. Since group-work in the department is generally short term such reallocations are often impractical since a large proportion of the assignment may well have already been completed, resulting in a less than welcoming reception for the reallocated student and problems in assessing the work of individual group members since the newcomer will normally have contributed much less. Another reason is that group-based assignments are well established in the department and, as such, if students became aware that problem groups were reallocated to other groups then there would be less incentive to make their group succeed. The approach normally taken in the department is for the lecturer to meet the problem group and attempt to resolve the problems.

## **SUMMATIVE                      ASSESSMENT                      OF                      GROUP-BASED ASSIGNMENTS**

Assessment of group-based assignments is a potentially difficult issue. What exactly are we trying to assess in group-based assignments? Is it the end product, or the process by which the end product was produced, or the non-cognitive skills employed, or a combination of all three? In many courses the emphasis is normally on assessing the end product in the safe knowledge that the process by which it was created and the non-cognitive skills employed in its creation must have had an influence on the end product and as such are also being assessed albeit indirectly.

Having assessed the end product, how should marks be allocated to individual group members? The easy option, of course, is to assign all group members the same mark. This obviously promotes mutual dependence between group members and collective responsibility for the group's achievements/failures, potentially motivating students to work together as a team. Unfortunately, this approach is an open invitation for slackers to get a free ride. It is also problematic in that the performance of group members within a group can vary widely, and in such cases awarding equal marks to all members of the group is plainly unfair (Nordberg, 2008). If this approach is taken then a group assignment should have a lower weighting in the overall assessment for a course, than would otherwise be the case, in order to minimise the risk of such unfairness (Johnson, D., Johnson, R. and Smith, 1991). If, however, the weighting is too low then, students will not engage with group-based assignments because it has little effect on their overall course mark (Stock and Stephens, 2008).

On the other hand, assessing group members individually, especially if it is norm-referenced (Smith, 1986), plainly introduces an element of intra group competition in order to gain higher marks thus negating some of the benefits of group-work. One approach to assessing individual group members is to base it solely on "Individual Reports".

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Generally group members are better placed than their lecturers to know what actually happened within a group and also to assess the process by which the deliverables were produced, although student produced diaries, meeting minutes, etc. can make this less opaque to the lecturer. On this basis, it is generally considered worthwhile and acceptable to make use of peer assessment in group-based assignments (Fry, 1990). With such an approach, however, there is no check, apart from possible unanimity of group members' views, on the reliability of group members' perception, honesty, judgement, lack of bias and the absence of reciprocation (Magin, 2001). It is The Department of Computing undergraduate course team's experience that individual group members often have difficulty quantifying individual contributions and often base their assessment on just one element when a basket of different elements (for example, effort, achievement, leadership, team spirit, helping others, etc.) would perhaps be more appropriate, and as a consequence students sometimes need guidance in this area.

In the Department of Computing the end product is assessed and each group is awarded a group mark that becomes each individual group member's mark. Individual group member's marks can, however, be increased/decreased depending on the contents of "Individual Reports" in which, amongst other things, students specify what percentage of the total group mark they believe should be allocated to each group member, including themselves, and whether they would like a group and/or individual viva voce examination (viva). If all group members specify an equal allocation of marks then all group members are always awarded the same mark on the basis that the group has plainly taken collective responsibility for its work, the group has probably worked well together and that group members' individual efforts have probably been mutually appreciated which are together a highly desirable outcome for a group-based assignment. If group members don't specify an equal allocation of marks but that allocation is not significantly different and is consistent between all group members then an adjustment is made to individual group members marks. If group members don't specify an equal allocation of marks and that allocation is significantly different and/or is inconsistent between group members (such variability being an indication of lack of reliability in peer assessment) then a viva of the group and each individual group member always takes place where an equitable distribution of marks is thrashed out. Vivas can be very successful because while students are often unrealistic or even lie in their "Individual Reports" they very rarely do so to a lecturer in front of their fellow group members (Stock and Stephens, 2008). Once the percentage of the total group mark for each group member is established then, the widely used approach (University of Melbourne Graduate School of Education Centre for the Study of Higher Education, 2002) where, arithmetically, the product of the group mark and the number of group members weighted by the percentage of the total group mark for a specific group member gives their individual mark, can be employed. Thus for example, for a three member group who achieved a group mark of 50% and whose members, it is established, contributed 50%, 30% and 20% of the total group mark then they would be awarded individual marks of 75%, 45% and 30% respectively. Such an approach is not without its problems. It is The Department of Computing undergraduate course team's experience that group members often have difficulty quantifying individual contributions as detailed above, often basing their assessment on just one factor when a basket of different factors (for example, as previously, effort, achievement, leadership, team spirit, helping others, etc.) would perhaps be more appropriate while individual group members are often surprised that, what they consider, a small change in their percentage contribution can have a large effect on their individual mark. Note, given the simple algorithm above, that it is possible to achieve an individual mark of more than 100%! For example, consider a three member group who achieved a group mark of 50% and whose members, it is established, contributed 70%, 20% and 10% of the total group mark then one group member would be awarded individual mark of 105%! Plainly there is a need for marks to be capped and/or the employment of a more sophisticated (non-linear) algorithm. The simple nature of the algorithm above also raises issues of possible over generosity and meanness in the allocation of marks between group members. For example, consider a three member group who achieved a group mark of 50% and whose members, it is established, contributed 60%, 30% and 10% of the total group mark, then they would be awarded individual marks of 90%, 45% and 15% respectively. Such a scenario raises a few issues. Does one group member really deserve an individual mark of 90% for an assignment that only achieved a group mark of 50%? Consider the case of a student submitting an individual assignment that was assessed at 50% and who subsequently argued that they should get 90% because they spent much more time than normal on the assignment. Would we accept this argument? Of course not! Does one group member really deserve an individual mark of just 15%? If we are being generous to one group member then by the arithmetic nature of the algorithm we must be being mean to the other/s. Again, plainly there is a need for marks to be capped and/or the employment of a more sophisticated (non-linear) algorithm.

Data<sup>1</sup> is collected yearly in the Department of Computing for all course-work for both summative and analysis

<sup>1</sup> The "data" discussed here is the most recent available, at the time of writing, being for the 78 students who completed the 2011-12 year two BSc Database Systems I course and those who, a year later, followed this up with the 2012-13 year three BSc Human Side of Service Engineering (2019)

purposes.

Analysing the year two data it is noticeable that the spread of marks for individual assignments is much greater than that for group-based assignments as shown by the percentage relative standard deviation (%RSD) of 47% and 25% respectively. Statistically, the cause can be seen very clearly by a detailed analysis of individual student marks. If students' individual marks are taken as a reasonably accurate measure of their ability, then it can be seen that for students who are above average on this basis their group-work mark is generally lower and for students who are below average on this basis their group-work mark is generally higher than their individual mark. In practice, the course team believes that the cause is partly because a high proportion of groups decide that all members of their group should receive equal marks thus masking the full variability of actual individual performance. In addition, the correlation coefficient ( $r$ ) between individual and group-based assignment marks, at 0.4, is at best medium. Is assessment failing to discriminate accurately between individual students within group-based assignments? This is a difficult question to answer and the simplistic statistical analysis above gives little help. Firstly, it must be pointed out that individual and group-based assignments are not assessing the same thing, the latter is assessing students' ability to deliver as part of a group, which involves a different skill set, and as such, perhaps a high correlation between the two should not be expected. Secondly, by allowing groups to award the same mark to all group members will also reduce the level of positive correlation, again because the true level of individual performance within groups is masked. Finally, there is the possibility that group-based assessment is to some extent unreliable given the potential variability of students' individual performance within group-based assignments. Further analysis plainly needs to be carried out in this area.

Analysing the year three data, the difference between the %RSD for individual and group-based assignment marks at 30% and 27% respectively is not marked while the  $r$  between individual and group-based assignment marks, at 0.6, is high. This is perhaps surprising since a much larger proportion of groups in year three decide that all members of their group should receive equal marks. This should, *ceteris paribus*, result in a larger difference in the %RSD and a lower  $r$  between the year three individual and group-based assignment marks than those for year two, if the masking effect detailed above for the year two data is correct. In fact, the exact opposite has occurred. Something more significant has plainly changed between the two years. The course team believes that the major difference is that the year three groups are much more homogenous than those in year two. It is believed that less thought goes into group selection in year two. In year three, however, students are much more careful in that, for example, the more able and/or motivated students tend to group together. This results in both a lower difference in the %RSD and a higher  $r$  between the year three individual and group-based assignment marks than that for year two because, in terms of ability, the groups are more homogenous and as a result the masking effect, previously described, is less pronounced. It is also, of course, possible that collaborative working (even to an unacceptable level) on individual assignments rises in year three as a result of closer friendships and improved student ability at hiding such collaboration from the course team thus blurring the difference between group-based and, supposedly, individual-based (but in reality collaborative) coursework. Finally, it could be a combination of all of these factors. Again, further analysis plainly needs to be carried out in this area.

Finally, given the doubt over the fairness, and even the reliability, of assessing group-based assignments, they should never be a major weighting in the overall assessment of any course.

## CONCLUSIONS

In the Department of Computing student feedback from standard course review and evaluation procedures, contained within "Individual Reports" and that received, less formally shows that while a few students have poor experiences of group-based assessment for most it is very positive. It is also worth noting that there has only ever

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Database Systems II course. It could be argued that data collected over a much longer period would be more reliable but changes in assessment practice (e.g. the number of assignments and their overall course weighting, etc.) vary from year to year, particularly after revalidation of courses every five years, making any aggregation potentially problematic. Similar analysis of other cohorts has, however, always yielded broadly similar patterns. Note that the raw data has been scrubbed, for example, students who did not complete all the assessments in a specific year have been omitted. Finally, note that marks refer to those awarded to individual students *after* consideration of students' "Individual Reports".

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been one formal appeal against a mark awarded to an individual for a group-based assignment which was not upheld because the appellant mistakenly thought that they had been awarded a mark lower than that of their group whereas in fact the opposite was true! The department's approach to group-based assignments has evolved over the many years, not just to improve the teaching, learning and assessment process itself, but also to meet changing student skills, motivations and expectations as well as internal/external regulatory requirements.

Finally, there is every indication that group-based assessment is worthwhile in terms of both improved learning and the development of non-cognitive skills, but there is nevertheless also a significant risk in terms of assessment fairness. There is plainly a trade-off between the two and course teams must strike a balance while also minimising the risk of unfairness in assessment by careful assignment design, group allocation, management and assessment.

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