
CASE STUDY

A Modification of Bradshaw's Method of Group Allocation When You Do Not Know the Students

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Abstract

Noel-Ann Bradshaw's method for allocation of students to groups involves asking students to form small groups themselves which the lecturer pairs up to make large groups based on his or her knowledge of the students involved. This is a compromise between self-selected and lecturer- or randomly-assigned group allocation methods. The former is preferred by students, while the latter is perhaps more realistic of team work in employment. A modification to Bradshaw's method is proposed for circumstances when the lecturer does not know the students. This asks the small groups to perform a formative task with audio recording, to produce an outline (not word-for-word) transcript indicating group interactions and to reflect on group dynamics in discussion with the lecturer. This provides the lecturer with rich information about how the small groups operated, which can be used to pair the small groups to form large groups. It also provides the students with a formative learning experience and encourages the development of understanding and articulation of skills in relation to group work. A detailed description is given of the method used along with student feedback and lecturer reflection. The conclusion is broadly positive, with suggestions for minor changes to improve the method.

Keywords: Team work, group allocation, graduate skills, employability

Introduction

I was asked to design and deliver a new graduate skills development module based around group projects for the final year of a mathematics degree programme (not for my current employer). I will take it as read that graduate skills development in such a context is a good activity for students (for a discussion of relevant issues and case study evidence, see Waldock 2011).

MacBean *et al.* (2001) say that 'how groups are formed' can be 'a significant factor, influencing the students' marks for the task' (p9). They suggest that groups 'can be formed either by self-selection or be imposed by the member of staff responsible for the task' and say that 'students almost invariably prefer to work in self-selected groups'. They say that it

'can be frustrating for a student to be compelled to work with students that she/he is unfamiliar with, when a good working relationship already exists with other students in the same cohort', and that students 'like to work with other students of similar ability or with similar aspirations'. They warn about 'friction within a group' which may cause difficulties that can be avoided via self-selection (p8). However, groups in which students choose their own members are seen as less realistic, with Chadwick *et al.* (2012) reporting comments from employers that 'workplace teams are often drawn from different departments with members not necessarily knowing each other beforehand'. Indeed, Chadwick *et al.* have spoken to employers who seek 'evidence that graduates can work in a team rather than the fact that they have participated in a university-style group project' because of the lack of realism in the latter (p49). There is a balance to be struck.

I first came across Noel-Ann Bradshaw's method for allocating students to groups at the 'Ideas Exchange' meeting which I organised under the National Higher Education Science, Technology, Engineering and Mathematics (HE STEM) Programme at the University of Birmingham in July 2011. In the workshop report for that meeting, Mann (2011) refers to 'the vexed question of groupwork' and says that Bradshaw addressed at the meeting 'how to allocate students to groups without tears' (p55). Bradshaw (2009) discusses the tension between self-selection and lecturer-assignment to groups, and aimed to take an approach which is 'fair to the students' and provides 'a valuable lesson about working with others' (p7). She invited students to choose groups of three and email her their names with a choice of available project topics. To each group of three, Bradshaw added three more, either another group of three or a selection of three students who had not responded. She made this allocation 'with respect to ability, friendship groups and preferred topics'. Bradshaw reports student feedback that 'unusually for group work, the allocation of members to groups was seen as fair to all in the class', and also reports positive group dynamics (p8). Cliffe & Bradshaw (2012) discuss this method as being beneficial to students with autistic spectrum disorders, who will have the opportunity to 'identify peers with whom they have a rapport or shared mathematical interests' before being assigned to a larger group, reducing anxiety and improving communication (p46).

Bradshaw's method seems to offer an attractive balance between self-selection and lecturer- or random-assignment, giving all students the comfort of working with someone they chose along with the valuable skills development experience of learning to work with others they did not choose. However, the method crucially relies on the lecturer's ability to determine which students would be a good match for a group, based on knowledge of student ability and established friendship groups. In my case, I did not know the students before the module began. In this article, I outline the approach I took using a modification of Bradshaw's method. This involved a formative task which helped the students and me develop an understanding of the dynamics of each small group, and used this information to complete the pairing.

Small group formative task

As the focus of this article is on the group allocation method, other decisions taken regarding the group projects will be skipped over. However, it is important to know that I had a cohort of 44 students and had decided that groups would be large – eight or nine students – so that groups must subdivide tasks and could not just work together as a group of three or four might.

To end up with groups of eight or nine, using Bradshaw's method, meant that I asked students to assign themselves to small groups of four or five. One problem was those students who did not fit into such groups; I had one pair without a group and one group of six. I was quite determined not to force a grouping on any students. I explained that it was

important that they sort out the problem themselves and waited what seemed like a painfully long time – in reality it can only have been a minute or two – until the students suggested a compromise. This did mean that several students did not get their first choice of group members, so they may not have felt the full benefit of Bradshaw's method, but at least they made the decision for themselves.

I had these small groups complete a formative task called Zin Obelisk from NRICH (no date). The actual task used is not important to the process of group selection, so long as it does not take very much time and requires the group to work together. In the Zin Obelisk task, each group is given a set of 34 small pieces of paper which contain information relevant to the building of 'a Zin' in 'the ancient city of Atlantis'. Groups are asked to determine on which day of the week the obelisk was completed. The pieces of information include those about the dimensions of the obelisk, how time is measured in Atlantis and about the rate at which work is completed. Also included are several pieces of irrelevant information. Some examples are: 'The width of the Zin is ten feet'; 'Each block is one cubic foot'; 'Workers each lay 150 blocks per schlib'; 'The working day has nine schlibs'; 'Green has special religious significance on Mermaidday'. The task is only marginally mathematical, but arranging the information and interpreting its meaning is a good activity to occupy a small group for between 10 and 20 minutes and quickly exposes group dynamics.

Each group audio recorded and 'transcribed' their Zin Obelisk interaction. Some students were hesitant to be recorded, but I reassured them that they had control of the file, I did not want to hear it and they were free to delete it after the transcription. I was greatly concerned about the availability of recording equipment, and spent time asking around the department and rushing to the electronics shop to make sure I had enough ways of capturing audio. In the event, every group had a device capable of recording audio of sufficient quality for the task (a mobile phone) and some way of listening back to the recording (headphones).

Transcription was not precise, but gave an indication of what had been said and noted group interactions. The method is based on an initial data analysis method I heard about at a British Society for Research into Learning Mathematics Day Conference at the University of Manchester in March 2012. The paper on which the talk was based (Lowrie 2011) contains several examples of the method in use (pp10–12). I instructed students to arrange a column for each group member in a table and use rows to indicate time (but not to scale). For each interaction, I asked them to make a rough note of what was said by which team member and then place arrows between these notes to indicate who responded to whom. Anonymised example sections of resultant group interaction transcripts are shown in Figures 1 and 2. Transcribing took each group around half an hour, with some producing more detail than others. One problem was that a group which finished the Zin task quickly would have less to transcribe and so finish this much earlier than other groups, leaving them with little to do later in the process.

Self-assessment of group roles and pairing of groups

Following the group activity and transcription, I spoke a little to the whole class about team roles and operation of group activities. While pointing out that inherent problems exist with pigeonholing people based on personality types, I proposed that groups read descriptions of the Belbin team roles (Belbin 2011) as a simplified model that might be useful for understanding how their group worked. I asked groups to look at the transcripts they had produced and discuss the role each person had taken during the Zin Obelisk task and consider how their group had operated. For example, in the exchange shown in Figure 1

Person A	Person B	Person C	Person D
Right, I have all the information about the zin – it is 100ft high, 50ft in length and 10 feet wide. Chris, what is that?			
	50,000 feet		
		Each person works for seven schlibs a day because there are 8 ponks per schlib and each worker rests for 16 ponks, or 2 schlibs	
			Each worker lays 150 blocks per schlib
	There is only 8 people working in the gang because one of them is religious		

Figure 1 Group interaction transcript showing balanced contribution.

Person A	Person B	Person C	Person D
Arrange cards into categories			
	All responded		
Size of Zin?	55ft length	10ft width	100ft height
Calculate Schlibs/ponks	9 schlibs/day	8 ponks/schlibs	

Figure 2 Group interaction transcript showing Person A leading the interaction.

the group are freely throwing ideas back and forth between members in a fairly balanced way, while Figure 2 shows Person A leading the others in their interaction.

Following this, I spoke to each group in turn to look at their transcript and discuss their dynamic. It was interesting to note that the groups who finished the task quickly were the ones who self-identified as more balanced in terms of the Belbin roles. That is, these groups felt they had a member who came up with initial ideas (e.g. a Belbin 'plant'), someone who coordinated the others (a 'coordinator'), someone who was good at translating the ideas of others into action (a 'teamworker' or an 'implementer') and someone who is good at moving a task towards a conclusion (a 'completer finisher'). Those groups who completed the task more slowly generally felt that they either lacked someone to come up with ideas, so struggled to get started, or someone to pull together the threads to an eventual conclusion, so struggled to finish. The group that took longest over the task had neither an ideas person nor a finisher.

Based on these self-assessments, I paired the small groups into larger groups of eight or nine students. I drew a grid to cross-reference the role descriptions against each small group. Based on the self-assessment of roles, I paired these so that each larger group had: someone who is good at coming up with ideas but not necessarily following these through; someone who is good at coordinating the work of others; some people who are good at getting on with a task but not necessarily at coming up with ideas or pulling together a

conclusion; someone with the attention to detail to finish the job. I made no reference to names, gender or any other information about the students. These larger groups were kept for the three summative projects in the module.

Student feedback

A questionnaire was conducted at the end of the final class of the module via Google Forms. The introduction said: 'Please answer some questions about the module to help me reflect on how it went ready to run it again. All questions are optional, so please feel free to give as much or as little detail as you like. The questionnaire is anonymous so please feel free to be honest.' I took a 'cards on the table' approach, where I explained how I saw what had happened and my intentions via a series of statements about the module, and asked two questions about each: first, 'Please indicate how well you felt this aim was met' on a Likert-type scale from 1 ('Very badly') to 5 ('Very well'); second, 'I would appreciate any additional comments you may have on this aspect'. This directly and clearly asks students to address my intentions, but has the disadvantage that it might lead the students by indicating the answer I prefer. The analysis presented here is qualitative.

The two statements that are relevant to this paper are:

1. 'At the start of the module you undertook the Zin Obelisk task and the Car Parking task. These were designed to help you understand your individual role in group work and how your group operates.'
2. 'The method of assigning groups was that you chose a small group and were matched with another to form a larger group. The aim was so that you didn't feel like you were alone in your group but still you had to deal with the pressures of working with people you didn't choose.'

Forty-two of 44 students registered on the module completed the feedback questionnaire. All 42 answered the Likert-type scale for both statements. Table 1 gives the counts for each point on the scale for each statement. In addition, 15 students gave a free text comment for statement 1 and 19 gave one for statement 2.

Table 1 Answers to 'Please indicate how well you felt this aim was met' for the two statements.

Likert-type scale	Statement 1	Statement 2
1 ('Very badly')	0	3
2	0	2
3	4	7
4	27	13
5 ('Very well')	11	17

Statement 1 refers to 'the Car Parking task', a two-hour problem-solving session run as the first summative group assignment based on a brief from the problems bank created by Benjamin *et al.* (2012), not mentioned earlier. This was designed as a low stakes, in class, high pressure (short time scale) task to allow the new larger groups to get to know each other through a complete task cycle quickly, before going on to the higher stakes group projects. For this paper, I have removed any comments which referred directly to the Car Parking task. Any that refer to recording audio are Zin Obelisk comments as this did not take place for the Car Parking task, but there is unfortunate ambiguity over some of the other comments which cannot be resolved.

Table 1 shows students generally responding positively to statement 1, with 38 out of 42 students answering positively and no students answering negatively. As well as four positive comments that the tasks were enjoyable, five students commented about the tasks helping them to understand how they worked as part of a group, including: 'I felt it was a good task to start off with, especially as it really helped to me to understand the part I play best in a team'; 'Was good to record and listen back to ourselves to understand my role further'; 'Listening to the recording, it allowed me to understand how others see my role in the group and allowed me to build and change things if needed'. One student felt that what was learned in the Zin task did not translate to the larger group, saying: 'Definitely helped see how you worked within the initial team – however it was completely changed with the next exercise so didn't bare [sic] as much relevance'.

Table 1 shows five students responding negatively to statement 2, meaning they felt it had worked badly in relation to my intentions, and 30 students responding positively. Ten free text comments were positive, for example: 'I liked this grouping process better than random groups'; 'This was a really good idea as you still knew some people and then the others were new people so you still had to work with new people'; 'Thought that it was good how the groups were made to incorporate people who took various roles within a group'. Four comments referred to team roles or personality types as a positive part of the selection process.

However, there were four negative comments. When the groups were forming, not all students got their first choice (as described earlier), and this was reflected in one comment: 'When larger groups put together, people that were left over when choosing groups felt very out of the loop and not given the same chances or as high as marks as the rest of the group as not initially friends' (the comment about 'high marks' is because peer assessment of contribution was used for some summative group elements). There were also three comments which indicated that forming larger groups from two smaller groups could lead to division if the two groups do not mesh well, for example: 'Although, people don't feel alone within the group, this can lead to one group being more dominant over the other'; 'I think putting two groups of friends together is not a good idea and that it can cause a bit of a clash between the two groups'.

Two students wrote that they would have preferred the groups to change around between tasks, for example: 'This was probably the best way to do it, although I'd probably have preferred the groups to have been mixed around after project 2 (to further the aim of working with people you are less familiar with)'. Two students reported that their matched group contained people they knew well in any case, occurrences of which may be inevitable with final year students.

Discussion

The following is a summary of the modification of Bradshaw's method for group allocation:

1. Students form small groups.
2. Groups complete a formative task, make an audio recording and produce a group interaction transcript.
3. Student reflection on task and discussion with lecturer about group dynamic and members' strengths.
4. Lecturer pairs small groups to form larger groups.

Essentially, Bradshaw's method uses steps 1 and 4, with groups being matched using prior knowledge of the students. In the case where the lecturer does not know the

students, this modification allows the lecturer to gather useful information about the smaller groups before pairing these into larger groups.

In some ways, this modification is naturally less well-informed than Bradshaw's because I do not know the students, and this is reflected in some of the student feedback, such as when groups were matched in which everyone already knew each other well. In other ways, this modification is better informed than the original because, although I do not know the students personally or their performance in other modules, the process described does allow the discovery of detailed information about how the students perform in group work, which is extremely pertinent.

The modified method also has the advantage that students explore group work and their place as part of a group, and may even learn some language they can use to articulate their strengths in a job interview. I built on this aspect by setting an individual short essay with the title 'How our group operated and my part in it'. Of course, if this were desired, this process of self-reflection could be used even when the lecturer knows the students well.

There were issues in the feedback of division on the lines of the original small groups. The survey was anonymous, but from observing the groups during the module I suspect that these comments came from one group that had a particular personality clash. Had I known the students well then I might have been able to avoid this match. It is possible that this division is more of a risk the larger the original groups; Bradshaw had initial groups of three, while I had groups of four or five.

I used the method described to attempt to produce balanced groups which would have a good chance of being able to complete the module summative assessment tasks well. This method could have been used to attempt to produce mismatched groups for one of the projects and nicely balanced groups for another. This would perhaps be a valuable way to learn about what does not work in groups as well as what does, though this raises ethical issues around the allocation of marks for the 'mismatched' project.

Bradshaw has used her method with cohort sizes of 50 to 160 (personal correspondence, 9 September 2013). This modification is naturally more limited in numbers, because of the extra time needed to discuss the results with each group and, crucially, because of the effect that so many students talking at once would have on the audio recording process. To do this with as many as 160 would require several sessions and a lot of class time. Here I delivered this with 44 students; I would be hesitant to try it on my own in one session with more than 50.

If I were running this again, I would consider changing the group allocation part way through the module once I got to know the students better. I would also consider inviting students to contact me at the start with the name of any other student who they could not work with for exceptional reasons. Here, I learned late in the module that the cohesion problems in one group resulted from a particular set of personal circumstances between two students that I have not described here, but had I known about these at the start of the module I would certainly have not matched the groups together. However, to invite such requests would potentially cause more frivolous gripes to be brought to my attention and make the matching unworkable.

As a general principle, I like Bradshaw's method, despite the minority student feedback about groups falling back on the original two groupings in disagreements. Given that the alternative in this case was to let students choose their own groups or assign them randomly, I feel that this method produced a good outcome. Most students were positive about the group allocation and none complained that it was unfair (a concern of Bradshaw's), and it did produce in most groups a little of the friction that causes a more realistic learning environment. I believe my students will be able to talk to potential employers about how they dealt with

friction when working with others; an experience they likely would not have gained from self-selected groups. At the same time, this approach did not attract the sort of negative comments about fairness from students that MacBean *et al.* associated with randomly allocated groups. In a circumstance where I did know the students well, I would still consider using this method to get more relevant information about groups and because of the advantages in terms of skills development and increased articulation. One disadvantage is time; the process described took most of a three hour session.

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