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STRATEGIES FOR IMPLEMENTING GROUP WORK IN LARGE CLASSES: LESSONS FROM ENQUIRY-BASED LEARNING

Geraldine O'Neill, University College Dublin, and Ivan Moore, Sheffield Hallam University

Introduction

The theories of learning that appear to be gaining the most attention in the recent educational literature emphasise the importance of the social and dialogic aspects of higher education (for example, Woo and Reeves, 2007; Boekaerts and Minnaert, 2006; Carlile and Jordan, 2005; Lave and Wenger, 1999; Roth, 1999). At the same time, the development of and support for innovative teaching strategies and programmes are key aspects of higher education policy. Group work is just such an innovative strategy, which can foster the social and dialogic aspects of learning. Unfortunately, academic staff's efforts to promote group work are often hindered by the resources needed to support it (Rangachari, 1996). In many institutions, it can be difficult to implement group work comprehensively in large classes, particularly in large first-year and second-year undergraduate programmes. This reduced opportunity for social and peer-supported learning can be a key factor in inhibiting both student retention and social learning.

Enquiry-based Learning (EBL) has also been gaining prominence in undergraduate programmes internationally (Pastirik, 2006; Roberts *et al*, 2005; Kahn and O'Rourke, 2005). EBL can give learners the opportunity to develop professional and personal skills ranging from teamwork and leadership skills to problem-solving and information skills, as well as personal attributes such as the ability to take responsibility for their own learning and actions (Barrett *et al*, 2005; Savin-Baden, 2004). EBL creates an environment in which the learners, often working in groups, are supported in determining their own lines of enquiry. They identify what is known; what needs to be learned; what information is required; how it is to be acquired, processed and applied; and how it is to be shared with others (Barrett *et al*, 2005). This approach is not new to many disciplines, where it may previously have been described as problem-based learning (PBL) (Savin-Baden, 2004), design exercises, investigations, case studies or project-based learning. The essential, common ingredient is that an initial "trigger" (the problem, design specification, area for investigation or case) stimulates the group to pursue a particular line of enquiry, through which learning is achieved. The groups are supported by a range of resources including online, paper-based and human resources.

In this chapter, we aim to consolidate and disseminate some ideas on how to organise group work in large classes in higher education. In particular, we draw on both the literature and some case studies from EBL practices in Ireland and the UK to argue that EBL can activate social and dialogic learning in group-work situations in innovative ways. It is not our intention to cover all aspects of EBL, such as assessment, which can be explored in other publications (Barrett *et al*, 2005). We believe that the lessons from these EBL cases are transferable to other group-work situations in higher education.

Theories of group work in teaching and learning

Historically, the emphasis given to learning from others has varied significantly across different learning theories. The early cognitive theorists maintain that learning occurs in the "mind", although Piaget (1896–1980) did note that children learn from other children (Rogoff, 1999). Another more recent and very influential theory is constructivism, which

highlights the importance of building on previous knowledge and making sense of information:

Whereas the Cognitivist tries to take charge and direct the students' thinking, the Constructivist accepts the autonomy of the student, and instead acts as a facilitator or mediator. The Constructivist helps the learner to discover meaning and understanding, rather than simply to accumulate information (Carlile and Jordan, 2005, p. 19).

The constructivist view of teaching is consistent with the increasingly common view of the teacher as facilitator in higher education learning; facilitation is, of course, an important skill for teachers and students involved in group work. Social constructivism may be even more pertinent to an understanding of how learning occurs in groups. It "directs our attention not to the individual who tries to build an understanding independent of others, but instead to individuals who become functioning members of communities before they become Selves" (Roth, 1999, p. 10). Recent literature in the area of e-learning, in particular, draws on the social constructivist view of learning (Woo and Reeves, 2007) and considers how to apply this in practice (Jacques and Salmon, 2007).

Biggs (1999) highlights the importance of active learning and student interaction in promoting deep learning in higher education. He advocates the use of peer discussions, peer-assessment and group work. Light and Cox (2001) note that group work has four key purposes – intellectual, social, personal and practical. Oakley *et al* (2004, p. 9) observe that students taught in groups "achieve higher grades, learn at a deeper level, retain information longer". This is in addition to the development of interpersonal skills such as communication and teamwork. Oakley *et al* (2004) also distinguish between "group work" and "teamwork", the latter of which they describe as "cooperative learning". They outline some useful strategies that enhance teamwork in groups, including the development of team policies, evaluation of effective team functioning and peer ratings (of workload, preparation, participation and so on).

Group work in Enquiry-based Learning

What is Enquiry-based Learning?

Enquiry-based learning (EBL) is a term used:

to describe approaches to learning driven by enquiry. The tutor (lecturer) establishes the task and supports or facilitates the process, but the students pursue their own lines of enquiry, draw on existing knowledge and identify the consequent learning needs. EBL is usually organised around collaborative work in small groups or with structured support from others, thus promoting the social interaction and cohesion that can be difficult in a mass system (Kahn and O'Rourke, 2005, p. 1).

The advantages of EBL are that, in addition to specialist knowledge, students develop skills in critical and creative thinking; communication; information retrieval; self-directed learning; project management; teamwork; and problem-solving. In general, they also enjoy the process (Albanese and Mitchell, 1993; Cowan, 1998; Norman and Schmidt, 1993; Barrett *et al*, 2005). EBL also assists "in synthesising learning, which can be an issue in modular and interdisciplinary programmes; enquiries typically cross boundaries" (Kahn and O'Rourke, 2005, p. 2).

The terms EBL and PBL are often used interchangeably in the literature, but there are some important differences between the two types of learning. Kahn and O'Rourke (2007, p. 4) present problem-based learning (PBL) as a subset of enquiry-based learning, with the other two subsets being small-scale investigations and project work. Tosey and McDonnell (2006) make some distinction between EBL and PBL, however. In particular, they note that in EBL, "the learner has significant influence on or choice about the aim, scope and topic of their learning", whereas in PBL, the "tutor establishes the task" (Tosey and McDonnell, 2006, p. 2). Barrett (2005) agrees, adding that students define their own learning issues from the problems given to them by their teachers. Another important distinction is that PBL always involves group work, whereas EBL can at times be individual enquiry – that is, a small-scale research investigation. In addition, PBL uses a set process for its group work – for example, the Maastricht process (Schmidt and Moust, 2000, p. 23) or the Barrows process (Barrows and Tamblyn, 1980).

Despite the confusion in the literature about whether EBL and PBL are interchangeable, distinctive or overlapping, they usually have some features in common. In this chapter, we will focus on the following:

- a process of enquiry usually stimulated by a real-life scenario
- a self-directed aspect
- a collaborative aspect – that is, group work (as we have noted above, EBL does not always involve collaboration, but here we consider examples in which it does).

In this chapter, we will use the more encompassing term EBL (Kahn and O'Rourke, 2005; 2007). Readers interested in pursuing the differences and overlaps between EBL and PBL should see Tosey and McDonnell (2006).

Organising Group Work in EBL

EBL usually involves group work organised to undertake a common activity where the students lead or choose the line of enquiry, with or without a predetermined process. The intended outcomes of some group work activities may involve simple discussion, whereas others may involve making or designing an item. The latter has a less defined format and is often organised by students in out-of-class time. Students may also be familiar with this type of group work from previous educational experiences. Group size varies considerably in EBL and can be as small as two students (although this is rare). There is usually a group facilitator, who can be either a student or a tutor (staff member or senior student). Students often benefit from initial guidance on group processes, especially if they are unfamiliar with them. EBL is usually more successful if accompanied by early student education on group dynamics and the setting of ground rules (Oakley *et al*, 2004)

Activities involved in group work vary between facilitated group sessions, usually at fixed periods in time, and periods of unfacilitated group work by the students. It can be challenging for teachers to achieve the right balance between supporting students and leaving them to work independently, and "many ... facilitators appear to oscillate between being directive toward the students and saying very little at all" (Kahn and O'Rourke, 2007, p. 6).

Students and tutors can have quite distinct roles in the EBL group-work process. Roles include group leader (chair): groups may be chaired either by a student group member or by

the tutor. The subtly different role of facilitator is usually undertaken by the tutor, and involves providing guidance and feedback to the group. The tutor may or may not be an expert in the subject area (see Schmidt and Moust (2000) for a review of studies of student and tutor chairs, and expert and non-expert tutor chairs). In addition to the chair, there is often a student scribe who records “the group’s problem-solving on whiteboards or easel paper” (Hmelo and Evensen, 2000, p. 2) and other student roles such as reader or time-keeper. These student roles actively involve students in the group process and encourage group ownership.

Considerable space and staff resources are required if tutors facilitate EBL groups. In addition, enquiries may involve several facilitated sessions (in-class and/or online). Given these requirements and demands, it is not surprising that those teaching large classes default to lectures. Nevertheless, staff members who have attempted EBL have addressed the issues described above, and this chapter will explore some examples from the literature and from current practices known to the authors.

EBL survey

We surveyed coordinators of large-class EBL modules in the UK and Ireland to discover what strategies they use to implement group work in EBL environments. We designed a semi-structured questionnaire to gather information on:

- the module (student numbers, discipline, year of study)
- the extent to which EBL is used in the module (curriculum design)
- how group work is organised in the module (including e-learning)
- how group work is timetabled.

We handed these questionnaires individually to the module coordinators, and were able to build nine case studies from the responses:

1. Electrical Engineering, Loughborough University, UK
2. English Literature, University of Manchester, UK
3. Geography, University College Dublin, Ireland
4. Manufacturing Engineering, Loughborough University, UK
5. Occupational Therapy, Trinity College Dublin, Ireland
6. Educational Theories, University College Dublin, Ireland
7. Computer Science, University of Manchester, UK
8. Veterinary Medicine, University College Dublin, Ireland
9. Manufacturing, Automotive and Civil Engineering, University of Manchester, UK.

More detailed information on these cases is available from the UCD Centre for Teaching and Learning website at <http://www.ucd.ie/teaching/projects/epl/AISHE2007.html>.

Strategies for implementing group work

The case studies confirm the literature’s identification of four main strategies for implementing group work in EBL: group organisation and facilitation; timetabling; e-learning; and curriculum design. E-Learning appears to be used very successfully in scaffolding the organisation of the groups, and helped teachers monitor group activity – for example, through collaborative and exchange tools and content and creation tools (Woo and Reeves, 2007; Jacques and Salmon, 2007; Oliver, 2006; Smith *et al*, 2005). This e-learning activity is strongly linked to the strategy of group organisation and facilitation; therefore,

we have incorporated e-learning into the discussion of group organisation and facilitation below.

The discussion below integrates the findings from the literature and our case studies, and discusses these findings under the following headings:

- group organisation and facilitation (including e-learning)
- timetabling
- curriculum design.

It should be noted that in practice these strategies are often used concurrently.

Strategy 1: Group Organisation and Facilitation (including e-learning)

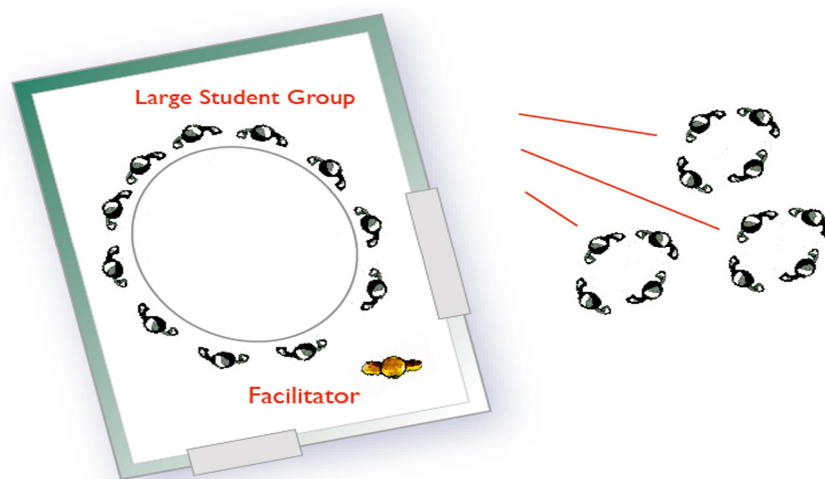
This strategy is the most complex, comprehensive and diverse. In large classes, group organisation and facilitation vary greatly according to context, but here we explore four main approaches within this strategy:

- independent subgroups from a larger group
- the roving tutor
- train the trainers
- combination of the roving tutor and train the trainers.

Independent subgroups from a larger group

In this approach, a large group meets with the facilitator/lecturer and then the students subdivide for work outside the facilitated session (Figure 1).

Figure 1: Independent Subgroups from a Larger Group



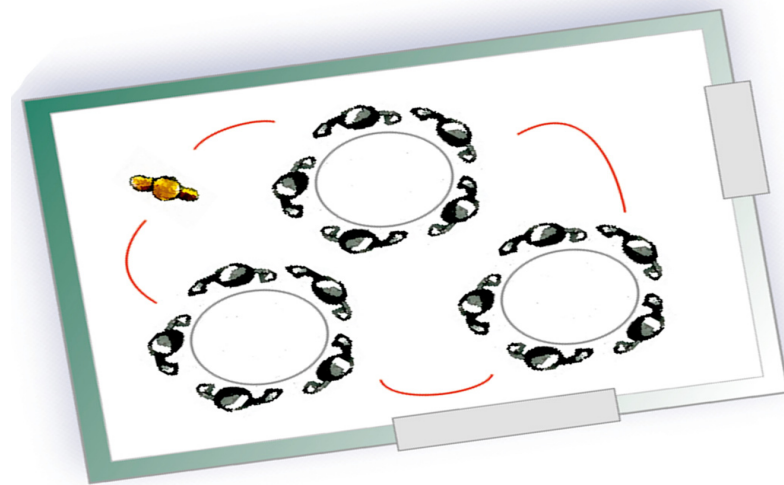
In case study 1 (Electrical Engineering), a class of 80 second-year students were divided into the equivalent of four real-life “companies”, each with 20 students. Four robotic Olympic events had been defined (sprint, basketball, javelin and high jump) and each company had to design and build a robot to compete in each of the four events. The company therefore divided into a further four sub-groups (n=5 students) and met outside timetabled sessions. The whole company met on a weekly basis. This weekly company “board room meeting” was chaired by the tutor or a departmental professor. In addition to the weekly board meeting,

the students sought advice from other staff members, described as “consultants”. This approach to group work, as in many enquiry-based approaches, has the advantage of mirroring the real-life group process that engineering students may encounter in industry.

The roving tutor

The second approach in the group organisation and facilitation strategy is probably one of the most common, particularly when more traditional PBL processes are being used. In this situation (Figure 2), a staff facilitator roves among student-chaired groups, monitoring the students’ (in particular, the student chair’s) adherence to the steps or categories of the PBL process (Schmidt and Moust, 2000; Barrows and Tamblyn, 1980).

Figure 2: The Roving Tutor



This approach was used in a second-year nursing programme at a Canadian university (Pastirik, 2006). The study of this programme explores the application of PBL in a class of 42 students with one tutor. In this scenario, students had an initial introduction to the PBL process, with information available online. Following this, students were divided into six groups of seven students and met in the classroom with the full cohort. The students chaired/facilitated the groups according to set instructions, with a “floating” or roving tutor (see Figure 2). Having brainstormed and decided on their learning goals, they presented these back to the full cohort (six sets of goals). These goals were combined into one to two topics by the tutor and students and then redistributed to the groups. Each group reformed to allocate these redistributed goals to individual students. The students then contributed their individual findings to the online group discussion forum, where one student synthesised the material for each group. This aspect of the process replaced the face-to-face discussion that often occurs in more standard PBL processes. One student from each group then presented the findings back to the full cohort of students in the next face-to-face session. Groups then reformed in the class to evaluate their progress towards their aims.

The online environment was put to good use in this scenario to facilitate discussion. But it seems there was no small group face-to-face discussion of the findings. The presentation of seven different findings to the full cohort would have given a good overview of the full problem, but more than seven presentations in a single session would be difficult to manage

in groups larger than 42. Therefore, this approach seems manageable for numbers up to this size. Students were generally positive about the experience; they were initially uneasy with the process but gained in confidence over the semester. Their concerns included students “who did not pull their weight” and the issue of student anxiety when presenting to the larger group (Pastirik, 2006, p. 265).

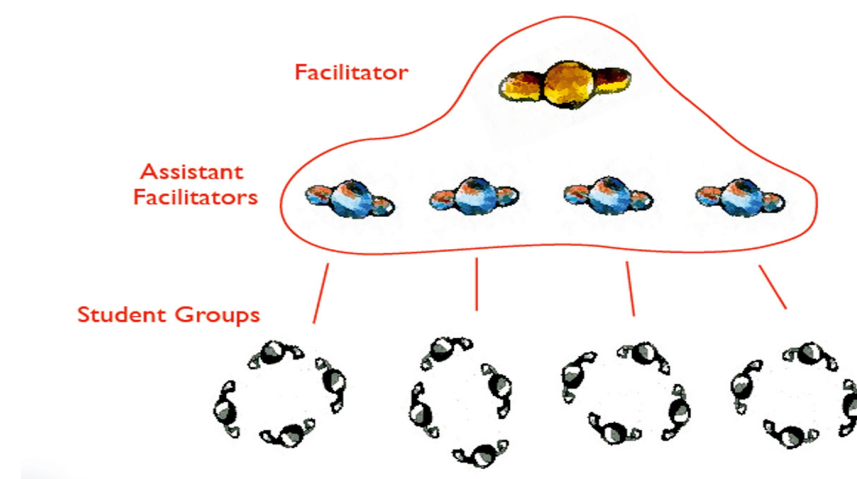
Woods (1996) reports on the use of “tutor-less groups” in a class of 50 students in Chemical Engineering. Like the process studied by Pastirik (2006), students also facilitated their own groups following a period of group-work induction. In Woods (1996), however, an online environment was not used; rather, students carried out some worked examples of problems in Chemical Engineering in a third session. Woods (1996) carried out a thorough evaluation of this approach and discovered that the students’ problem-solving skills and self-directed skills, measured using standardised inventories, improved over the duration of the course. Alumni and employers surveyed also commented on the effectiveness of these students’ problem-solving skills.

Case study 2 (English Literature) also employed this approach as did case study 5 (Occupational Therapy) on occasions. In these programmes, the emphasis was on face-to-face interaction; they did not use the online environment.

Train the trainers

The train the trainers approach is also common in many traditional group tutorial settings. In this approach, the key academic teacher works (outside the classroom context) with some assistant facilitators (for example, graduate students or tutors) to improve their group facilitation skills. The assistant facilitators then work directly with student groups (Figure 3).

Figure 3: Train the Trainers



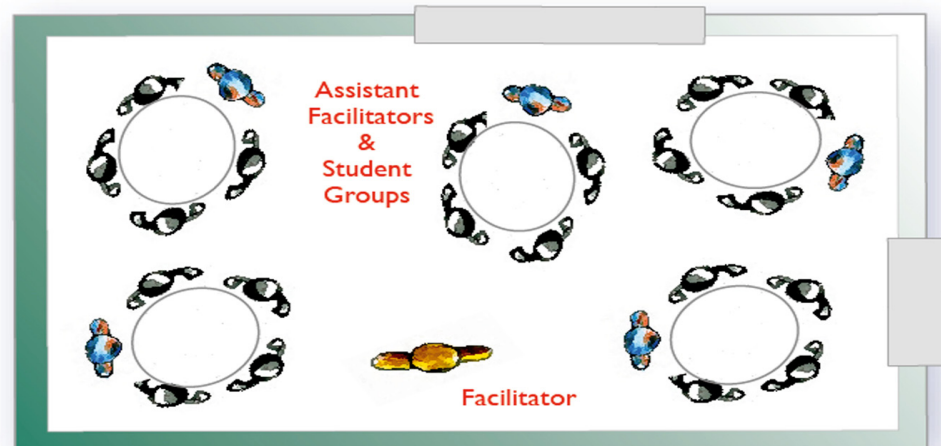
This approach, which can be an effective use of the lecturer’s time in a large class, was implemented in a class of 400 first-year Geography students (case study 3) where a large proportion of group work was undertaken in small-group tutorials run by geography postgraduate students. The lecturers designed the tutorials and provided training on content for tutors.

This case study relied heavily on the Moodle e-learning platform, because the face-to-face tutorials (16 students) were further subdivided into two groups of eight students in an online discussion. The lecturers designed assignments to be submitted online and used online tools such as discussion boards and wikis. The Geography lecturers integrated material from the students' online discussions back into lectures, which they believed motivated students to engage in the online discussion and gave them some control over the module's evolution.

Combination of the roving tutor and train the trainers

The final approach used to implement group work in EBL environments appears to be a combination of the roving tutor and train the trainers. In this approach, the lead staff facilitator supports some assistant facilitators (tutors or senior students) while roving around the classroom (Figure 4).

Figure 4: Combination of the Roving Tutor and Train the Trainers



An example of this approach is described by Roberts *et al* (2005). In a class of 250 first-year medical students, 22 groups were organised to carry out an “integrated learning activity” (ILA). In this ILA, all 22 groups attended a lecture theatre where they watched a video on the first problem. In their groups, the students then brainstormed the first five of the seven Maastricht PBL steps (Schmidt and Moust, 2000), with two staff “floating” in the lecture theatre, so there were 22 tutor-less groups. Each group was instructed to nominate a group leader. The two staff facilitated any questions as they emerged. A student-only meeting “was timetabled at the end of the first week to enable students to check progress” (Roberts *et al*, 2005, p. 529). Following this, each student group leader emailed their learning objectives and a summary of their group work to one of the facilitators. Roberts *et al* (2005) emphasise that tutor training was a key ingredient for success in this approach.

Case study 4 (Manufacturing Engineering) also used this approach in a class of 112 second-year students. The focus of the enquiry in this case was an industry-based project, in which seven companies were established, each consisting of four teams of four students. This resulted in 28 different groups of four students. Each group was supported by a staff tutor and a fourth-year student mentor. The student mentors regularly facilitated their student

groups independently. Occasionally, the whole company met and industrialists were invited to join these meetings, giving rise to meeting sizes of up to 22.

Strategy 2: Timetabling

The next strategy to support students working in EBL environments in small groups illustrates the creative use of timetable design. In the literature, a cycle of EBL appears to occur twice a week in many of the Health Science programmes; however, this is not always possible in a large class. To support this in multiple groups, some coordinators organise for one group of students to meet, for example, on Tuesday and Friday, while the other group meets on Monday and Thursday (or alternatively two groups on the same day). These extra teaching hours for staff could be a disadvantage, however, and there is still a limit to how many groups can meet in a week. Case study 5 (Occupational Therapy) concerns a group of 40 students: here the tutors timetabled two groups in a day, so there were 1.5-hour, back-to-back tutorials with four groups of 10 students each, with two tutors tutoring for three hours in one day.

When twice a week is not possible, a cycle of EBL could occur for one group of students weekly or fortnightly. For example, each group could meet the staff facilitator once a week or fortnight and work independently in between. This meeting could be either a timetabled or a tutor-appointment slot (case study 7, Computer Science). In case study 6 (Educational Theories), face-to-face sessions were timetabled once a fortnight and the students worked independently in between.

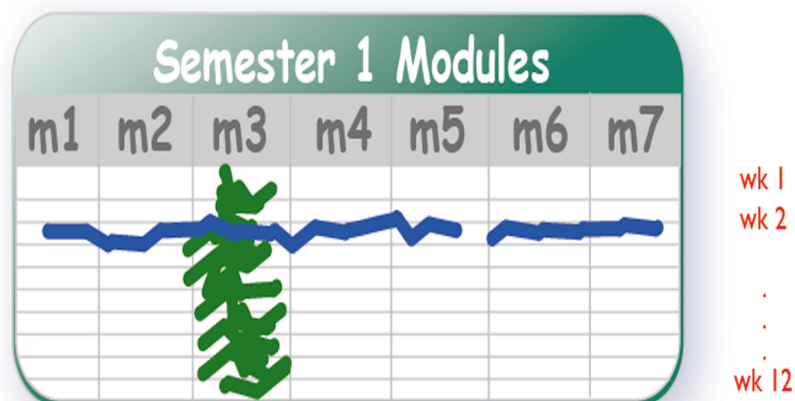
In the literature, Woods (1996) presents an example of an EBL problem process that lasted for one week only, in contrast to Pastirik's (2006) two-week cycle for one problem.

Strategy 3: Curriculum Design

The final strategy involves making decisions about where and how EBL is used in the full programme. The strategic introduction of EBL across a full programme offers more opportunity to take advantage of the programme's collective resources.

One approach within this strategy is to select a core, sometimes integrated, module in each year (m3 in Figure 5) and put resources into this module for EBL group work.

Figure 5: Selecting a Core Module or a Core Week



In case study 8 (Veterinary Medicine), for example, EBL modules aimed at generic skills development in veterinary clinical scenarios were organised as stand-alone components of the veterinary course. However, the students were encouraged to link material from other modules. The module coordinator noted that the modules' intended learning outcomes were to integrate student knowledge across subject boundaries; to add to student knowledge as part of a team; to identify, retrieve, abstract and prioritise relevant new information; and to analyse and resolve possible courses of action and rank their appropriateness. In the literature, this type of module is often described as a "synoptic" module if it achieves the aim of integrating material from other related modules. A programme team may decide that this is an economic approach to allocating resources to group work across a few semesters/years

Another approach is to focus the group EBL experience in one or two weeks of the semester or term and integrate all modules in the programme (blue line in Figure 5). In this approach, tutors from multiple modules come together to work intensively on the same one-week or two-week group projects. Case study 9 (Manufacturing, Automotive and Civil Engineering) is a good example. In this first-year programme, all modules were suspended in week 5, and students from all courses in the year met to work in groups on an EBL exercise that was intensely pursued over the week. This had an added advantage of freeing up academic staff to support the activity.

These two approaches appear to require more input from strategic senior staff – for example, head of school or programme. Therefore, not all academic staff will be in a position to implement this strategy.

Discussion and conclusions

This chapter has presented three distinct strategies that may be used by academic staff teaching large classes to implement the group work required for EBL. Many of the examples both in the literature and the case studies, however, use a combination of these strategies.

The first strategy, group organisation and facilitation, is an option available to staff who have control over how the groups are organised. It can be broken down into four diverse approaches. Some of these approaches, such as the roving tutor, appear to be more practical at the smaller end of the large-class continuum – that is, in groups of 40 to 50 students. Other approaches, such as train the trainers, have been implemented in very large classes (between 150 and 400) and do require some additional resources, such as tutors or postgraduate students. Smith *et al* (2005, p. 154) describe how their postgraduate students, who became EBL teaching assistants, moved from being assistants to being "partners with the faculty (staff) in carrying out the course goals".

It appears that e-learning was used across these different approaches when there appeared to be a danger that the monitoring of progress was a concern, such as in extremely large classes, or where the students were doing more independent group work. Oliver (2006), who also used EBL with a group of 350 students, argues that the technology in this context provides an opportunity for staff to scaffold learner-centred individual and group-based learning. Technology can very easily track group contributions gathered in one space, which is much more difficult to achieve in the large-class face-to-face context. The recent e-learning literature (Jacques and Salmon, 2007; Woo and Reeves, 2007) increasingly

supports the more streamlined use of group work online. Staff who are developing new e-learning activities may need additional institutional support.

The other two strategies, timetabling and curriculum design, both require more senior input into EBL implementation. Curriculum design, in particular, may require a head of school/programme decision to redeploy resources; heads of school/programme may also need to develop their curriculum designer role, a role often neglected in their busy managerial lives. The approach of selecting a core module in each year of a programme has been described as a hybrid approach in the PBL literature. Some authors argue strongly that PBL should be all or nothing and that hybrid programmes are not pure PBL (Armstrong, 1991). Nevertheless, in practice hybrid programmes are widespread and research into them has demonstrated evidence of a range of successful student learning outcomes (O'Neill, 2007).

In conclusion, this chapter provides the reader with some ideas for implementing group work in large classes, by drawing on lessons from both the literature as well as Irish and UK EBL case studies. We hope that this will promote some debate on the bigger issues of redistribution of resources and change in lecturer/tutor/head of school roles that are needed to support an increase in group work. It will be necessary to carry out more comprehensive research into these strategies – for example, on best practices in student assessment and/or evaluation of these strategies. In the meantime, we hope that we have empowered readers by giving them some starting points.

Acknowledgements

Many thanks to Diane Cashman who designed all the artwork (Diane Cashman, Centre for Teaching and Learning, UCD diane.cashman@ucd.ie). Many thanks also to the module and programme coordinators who completed the questionnaires for the nine case studies in Ireland and the UK.

Note

This paper was presented originally in poster format at the All Ireland Society for Higher Education (AISHE) conference (O'Neill and Moore, 2007).

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