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# Advantages and Problems in Using Information Communication Technologies to Support the Teaching of a Multi-institutional Computer Ethics Course

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**ABSTRACT** *The ‘political push’ and technological ‘pull’ currently prevalent in many higher education institutions is encouraging educationalists to increasingly experiment with tools that promote collaborative work, which, in turn, is perceived to help in the development of more autonomous, responsible learners. This study will focus on the advantages and problems of using Information Communication Technologies to support a blended learning approach to the teaching of a multi-institutional Professional Issues/Computer Ethics course. First, it will examine how the collaboration was facilitated by the use of a commercially available collaborative learning management tool, Blackboard. It will detail how Blackboard was used in two fieldwork studies (years one and two of this collaboration) to enhance the teaching of professional issues in computing/computer ethics at the University of Limerick in Ireland, at De Montfort University in England and at Sacred Heart University in the United States of America. Next, it will examine how, in the second year, the Belbin (1981) Self-Perception Inventory was used to help in the establishment of virtual teams by getting students to consider individual differences in determining group roles. Finally, the results in terms of outcomes and student/staff reactions will be given.*

## Introduction

In the field of education, Information Communication Technology (ICT), with its Web-based resources, has served as a driver of change in the areas of both distance and campus-based learning. Technological developments such as the Internet and

tools for browsing have now, for example, made educational collaborations a reality, irrespective of physical distance. It was this, together with the fact that the modules being taught were of a discursive nature and related to professional issues in the use of ICT, that prompted the authors to start using computer-supported collaborative tools such as Blackboard to support their teaching. A Professional Issues/Computer Ethics module does, of course, lend itself to interactivity because of the range of current topics and the need for a dialectic on the subjects at hand. For example, students studying such modules are required to explore the various ethical issues that stem from the use of ICT and to understand and appreciate how society both affects and is driven by technology. As such, much discussion takes place in the face-to-face (f2f) contact sessions. However, it is recognised that in the f2f situation there are a number of constraints that impact the interaction that actually takes place and that, as Fleischman points out, “in classroom discussion it is not routinely possible to depend on a lively diversity of viewpoints when engaging a particular text, case study or issue” (Fleischman, 2001, p. 171). Thus, using the technology “to push back the threshold imposed by these constraints”, by “opening up new media for discourse that are not subject to the same delivery bottlenecks as traditional methods [OECD, 1996]” (Lee *et al.*, 1998, p. 124) could offer new opportunities for supporting learning. Thus, each of the tutors had started to use virtual learning environments such as Blackboard or WebCT to facilitate discussion amongst the students outside of the normal f2f contact time. However, setting up an international collaboration using this same technology opened up even more opportunities for students to engage with students in other countries, thereby allowing them to gain first-hand experience of the issues raised in a global context. Using the asynchronous, text-based medium of computer conferencing also encouraged the students to reflect more closely on their own particular use of the technology. Students were, for example, required to negotiate at a distance, to take account of time/cultural/language differences and to use ICT in a professional manner.

However, regardless of the technology, it was important that the modules taught in each of the three institutions were similar enough in nature for a multi-institutional collaboration to be feasible and this, following discussion, proved to be the case. For example, Professional Issues in Software Engineering (PISE) taught in the University of Limerick (Ireland) is a final-year undergraduate module for computer science students and focuses on the legal, ethical and social aspects of computing. The module taught at De Montfort University (England) is entitled The Professional Context of ICT. This module is also aimed at final-year undergraduates and aspects addressed are almost identical to those contained within the PISE module. The course offered at Sacred Heart University (United States of America), entitled Computer Ethics: Society and Technology, is required by all Computer Science/Information Technology majors. It focuses on the ethical and social aspects of computing emphasising that technology does not exist in a vacuum, but is developed for, and driven by, social forces. In addition, particular emphasis is given, in each of these modules, to the use of group work and peer dialogues that enable students to explore and critically analyse the ethical issues surrounding them as professionals involved in the design, implementation and use of ICT. The importance given to such activity is largely based on research into the development of

moral reasoning, a major pedagogical issue, which has shown that collaborative learning improves students' skills in this area. For example, research has shown that moral dilemmas in computer ethics encourage group discussion, that teamwork encourages social facilitation, better learning and higher cognitive skills (Hiltz, 1994; Saloman & Globerson, 1989) and that groups can produce better solutions to moral and ethical problems than individuals (Peek *et al.*, 1994). Because moral judgements are a social construct, it could also be argued that the development of a personal ethical code can best be achieved in a group situation. There also seems to be evidence that a collaborative approach to learning supported by instructional technology could potentially lead to deeper understanding and new knowledge creation (Mäkitalo *et al.*, 2001).

It was the authors' intent to establish studies that would investigate: (a) how tools such as Blackboard can be integrated with face-to-face (f2f) contact in order to facilitate collaborative learning; (b) what are the issues encountered in facilitating virtual groups collaborating across international boundaries; (c) how tools such as Blackboard can help cope with larger numbers of students; and (d) whether such use can enhance students' moral reasoning skills helping them to become better communicators and critical thinkers (see Griffin *et al.*, 2002).

### **Blackboard collaborative learning management tool**

The Blackboard system is an integrated set of Web-based tools designed for the creation and management of a virtual learning environment. These tools include: course development and management tools; statistical tools; content management tools; communication and collaboration tools; assessment tools; personal information management tools; academic Web resources; and system management tools. By using this 'shell' approach an instructor can build up a course site for any module with different types of learning materials and can use a range of communication tools to assist with the management and assessment of the module. Students can share files and use communication tools to contact other students and the lecturer either synchronously or asynchronously (see specific use of Blackboard in the 'Fieldwork studies' section).

### **Collaborative learning**

As noted, researchers have already identified the positive effects of social interaction during learning (Crook, 1999; Dillenbourg, 1999). Furthermore, collaboration with other students has been shown to stimulate activity, make learning more realistic and to stimulate motivation (Veerman & Veldhuis-Diermanse, 2001). It has also been suggested that not only is dialogue "an important aspect of a rich learning experience" (Lee *et al.*, 1997, p. 124), particularly in complex, discursive domains, but that "learning can occur not only through participation in dialogue but also through observing others participating in it" (Stenning *et al.*, 1999, p. 1). At the same time it is recognised that, as noted earlier, there are constraints that impact f2f interaction (Fleischman, 2001).

However, another major problem with the use of group-based approaches arises

when it comes to assessment. For example, although the PISE module has been taught for a number of years at the University of Limerick, increased student numbers (in this study there was a student cohort of 130) have added to the pressure to reevaluate the existing group teaching and assessment methods. How does the tutor ensure that individual students are working towards developing the concepts of personal and professional codes of ethical conduct (the dialectical process) and developing moral reasoning? How can students be assessed fairly using group work? How can weaker students be identified early enough to enable appropriate intervention? These are all questions that necessarily arise as a consequence of larger numbers. For example, the issue of some individuals gaining more (in terms of grades) than they have put into the process, a term that has been called ‘free-riding’ (Shepperd, 1993) cannot so easily be recognised and subsequently dealt with as with smaller cohorts. As Veerman & Veldhuis-Diermanse (2001) note, while larger groups can increase the advantages to members they can also increase the occurrence of free-riding due to the difficulty of monitoring them. Equally the potential for the group to be dominated by the stronger students, leaving the weaker students behind, can be a factor in larger groups. Thus it was decided, for this particular collaboration, that groups with a maximum of six members would be prescribed and that regular monitoring of the online conferencing activity would be undertaken in order to facilitate early intervention on any issues that might arise.

After the first year of collaboration (fieldwork study #1), the authors decided to evaluate the collaborative activity that had occurred on-line using the ‘Community of Inquiry Model’ proposed by Garrison *et al.* (2001, p. 2). This model was chosen because it suggests that for deep and meaningful learning to take place, one must look at the interaction of three elements: social presence, teaching presence, and cognitive presence in the educational process. Social presence is defined as the ability of learners to project themselves socially and emotionally in a community of inquiry. Rourke *et al.* (1999, p. 54) describe this element as “having the function of supporting the cognitive and affective objectives of learning”. Cognitive objectives, they believe, are supported by “making the group interactions appealing, engaging, and thus intrinsically rewarding” (Rourke *et al.*, 1999, p. 54), which can lead to a more successful completion of units of study by getting the learner to become more involved in the whole process. Teaching presence focuses on the design and management of learning sequences, provision of subject matter expertise, and facilitating active learning. Cognitive presence is defined as “the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication” (Garrison *et al.*, 2000, p. 4). These were all desirable outcomes of the collaboration and the authors were interested to assess how well their groups fitted in with this model.

### Fieldwork studies

Initially, however, in order to identify some of the issues in using technology to support collaborative learning in a multi-institutional, campus-based context, two fieldwork studies were undertaken. In both studies the authors created virtual groups

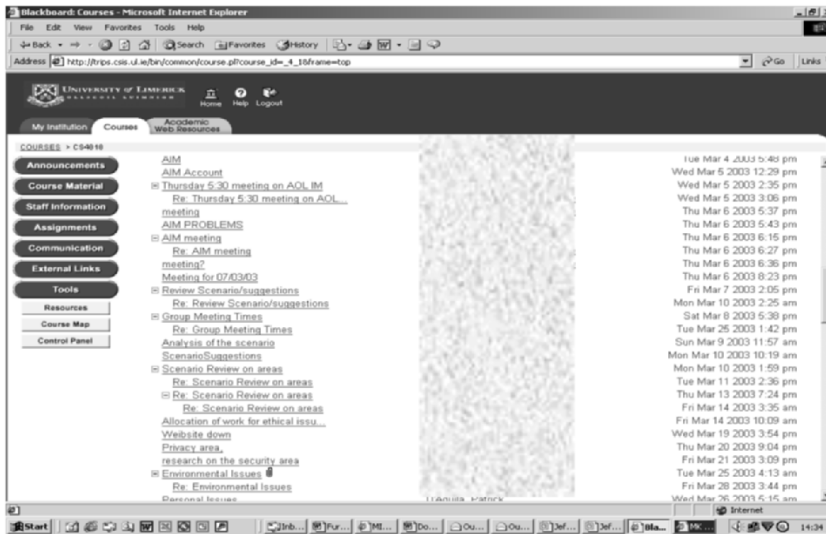


FIGURE 1. Group discussion area.

comprised of six students in total. Each of these groups were then provided with their own discussion area within the Blackboard system (see Figure 1).

It was the intention of the authors that each group would have two members drawn from each of the three institutions in order to facilitate both f2f and computer-supported collaboration. This was mainly achieved, but in the first fieldwork study the students from England and Ireland were able to choose their own partner for the group, but in the United States the students were randomly assigned as they did not really know each other. However, grouping together students from each of the three countries meant that they would all have the opportunity to gain first-hand experience of the different ethical viewpoints and legislation relating to the use of ICT through the discussions that were being facilitated across international boundaries.

### *Fieldwork Study #1*

The first fieldwork study started in the spring term of 2002 with seven fairly balanced groups although one group was smaller (four participants) and another was overwhelmingly Irish.

In order to integrate use of the Blackboard system into the f2f context, the authors had decided to make the assignment a scenario-based project that required students to discuss and evaluate the ethical issues related to a particular dilemma created through the use of ICT. The learning outcomes for this particular assignment included such things as evidencing their ability to work collaboratively as a group, evidencing an ability to construct, implement and evaluate a strategy for completing the assignment, development of their skills in using the technology by evidencing professional and appropriate use of the text-based conferencing medium

TABLE I. Functional use of Blackboard

Area name	Hits	Percentage
Group Pages	3709	15.61
Group Discussion Board	16634	70.09
File Exchange	502	2.11
E-mail	159	0.66

in their group discussion area, evidencing research and critical evaluation, as well as evidencing use of ethical theory to justify their proposed solution to the presented dilemma. Therefore, each group would choose, from a given selection, a scenario depicting an ethical dilemma related to the use of ICT. Their task was then to conduct an analysis of this scenario and present a collaborative report based on their research and threaded discussions. A number of documents were published by the authors to support students in achieving the required deliverable. These included project guidelines, scenarios, ethical analysis guidelines and material relating to ethical theories. This assignment was only part of the students' assessment and different weightings were allocated in each institution. At University of Limerick it counted as 50% of the course grade, in De Montfort University it was 20% and in the Sacred Heart University it was 10%. This was due, in part, to having to fit the collaboration into an already existing syllabus.

Creating a timetable was, however, one of the more difficult administrative tasks because each course started at a different time and vacations in the three countries were never at the same time. This was finally overcome by allocating a 4-week period for all collaboration to be carried out. Thus some students were only part way through their semester while others were nearer the end. This did not seem to cause any difficulty. Each of the authors agreed to 'visit' the group pages weekly to offer support to the groups and give direction where needed. Students were also able to e-mail any of the instructors with problems.

*Collaboration analysis* In the first fieldwork study, a student cohort of 41 and three instructors used the Blackboard collaborative learning management tool (CLMT) over a 9-week period. Statistics were gathered using the Course Statistics tool. There were approximately 23,364 hits in total over the entire period. These can be categorised as presented in Table I.

Table I indicates that although all tools in the Group Pages area were used, the group discussion boards were by far the most popular. These were used in three ways. Early in the project, they were used to facilitate introductions among the group members. After this they were then used for administrative purposes: organisation of the project, distribution of tasks, posting of research and the creation of timelines. Finally, the discussion board was the site of the threaded discussions about the scenario itself. As part of the assignment it was decided to give students the option to submit for assessment that part of their group discussion board that

related to the moral dilemma scenario, instead of the usual written report. For the threaded discussions, postings could be ascribed to individuals thus enabling the measurement of individual contribution. Three out of the seven groups submitted their threaded discussions as part of the final report.

*Analysis of teaching and social presence* Participants in all groups contributed to the organisation, the provision of documents that would afford subject matter expertise, and management of the groups. The three authors supplemented the teaching presence by reading the discussion boards and offering expertise when it was needed through either posting into the discussion area, sending e-mails or taking up issues in the f2f situation. Often, these messages were enough to kick-start the active learning process once again. Social presence (Garrison *et al.*, 2001) was observed as members of the groups introduced themselves and offered insight into their interests and personal likes and dislikes. The most social group exchanged online photographs of themselves at the start. It was obvious that several of these participants were friends by the light banter that went on in-between the serious group work postings and their postings often addressed each other by name rather than just starting off with a message. They were also careful to include the American participant who made up the other part of the group by making sure he 'got' the inside jokes. From this group:

Are you enjoying this collaborative work (?) Or do you think its all a load of old boots?

*American student:* I'm definitely enjoying what we are doing here, the fact that I'm the only American left in the group makes it hard to discuss with a classmate but I've brought the project as far as talking to my friends sitting around on the beach about this stuff!

Well isn't it well for some? Sitting on the beach!! ... I think this international collab is a great experience. It does, as you say, make you think more about consequences and it's good getting different perspectives so do continue to play devil's advocate!

This group decided to submit its threaded discussion (minus the jokes) as its report. It was felt that their ease of interaction led to some meaningful, in-depth discussion. Their paper proved to be one of the top two papers that were received.

*Analysis of cognitive presence* There are four categories in the cognitive presence element within the model proposed for the analysis of critical thinking and practical enquiry (Garrison *et al.*, 2001). These are: triggering events, exploration, integration and resolution. (There is a fifth category to represent non-cognitive interactions such as arranging meeting times, and so on, but it was not used in this study.)

For the purpose of this study, the most appropriate unit of analysis was the message as this combined "the flexibility of the thematic unit, which allows coders to capture a unit in its natural form, with the reliable identification attributes of a



TABLE II. Analysis of group postings

Group	Triggering	Exploration	Integration	Resolution	Total number of postings for each group discussion area
1	3	28	36	7	75
2	3	21	51	7	82
3	5	35	54	18	112
4	1	12	8	1	22
5	3	8	3	0	14
6	6	13	9	10	38
7	10	22	13	3	48

syntactical unit” (Garrison *et al.*, 2001, p. ?). Table II presents details of the analysis of the group’s message postings.

As can be seen, Group 3 received the highest number of postings of any group, and this correlated with the time they spent using Blackboard as a tool to sustain communication about their project. For consideration of cognitive presence, the authors also examined the type of message posted by the individual participants, as illustrated in Table III.

Group 3 had a cohort of strong leaders. One could attribute this to the fact that they all, except one, were from the same university and had been part of the same cohort for 3 years. Four out of the six in that group ranked among the highest in terms of the number of postings made. As can be seen from the analysis in Table III, Participant D took the lead in triggering the group. It was through his initiative that the scenario was selected. Participant B was the leader in the Integration phase and in trying to resolve the problem. Participant A was the consolidator of the group and was instrumental in helping the group reach consensus. Participant C did a lot of research for the group. These informal group roles helped immeasurably in the distribution of the workload. In Group 1, Participants E and F formed a pair from the inception of their group and took the lead in setting up the Exploration and

TABLE III. Individual participant’s postings categorised according to the Garrison *et al.* (2001) cognitive presence model

Participant	Group number	Triggering	Exploration	Integration	Resolution	Total number postings by each individual
A	3	0	6	11	5	25
B	3	2	11	15	7	38
C	3	1	11	11	7	33
D	3	3	6	12	2	26
E	1	1	8	14	3	27
F	1	0	6	9	1	17
G	7	2	5	1	2	17

Integration phases of their project. In Group 7, Participant G did most of the integration of the project while another member who had fewer postings did most of the initiation.

*Student feedback* After the coursework reports had been submitted, the authors distributed a survey about the use of Blackboard in the International Collaboration in order to discover the strengths and weaknesses of the tool and the online collaboration from the participants' points of view. There were 22 respondents to the survey. Of those, 13 used Blackboard daily and nine used it weekly. Fourteen students used it from 1 to 5 hours per week, and five students used it between 5 and 10 hours per week. Two students were on more than 10 hours per week and one student was on less than 1 hour per week. The majority of students found that Blackboard was most useful when they wanted to initiate or contribute to an ongoing discussion (thread) and for observing the on-going discussions to find out what was happening in the group. Students found it less useful for personal research. Most students felt that the online asynchronous nature of Blackboard was very important in all phases, but especially in the division of work. They found the tool easy to access and this was especially important in the initial set-up of the project. Most felt that the evidence of their own personal contribution to the paper was most important in the production of the final report.

Of the 20 students responding to whether Blackboard was useful for collaborative work, 15 said it was quite or very useful. The rest thought it had some use and the majority liked the international dimension that afforded them the opportunity to get to know students in other institutions. Factors that discouraged contribution to the online discussion were mostly a lack of self-confidence in the student's ability to make his/her views known to peers. Most students felt that they had the same commitment to the online group as they would have to a f2f group and would choose an online group again.

As in any class with any group of students, our random sampling yielded some students who worked harder than others. Some students were very focused on the goal of the collaboration while others were not. Some had excellent organisational and time management skills that helped keep their groups on track. In a group where time management was not a priority, there were poorer results. This would also be true in f2f groups. However, in this case, it was easy to ascertain the group difficulties and make suggestions because the instructors could participate on the group boards and monitor the discussions; that is, they were present at what is analogous to group meetings. As in any classroom, some students took the advice; others did not. Most problems were resolved online rather than f2f with the individual instructors at the universities. Overall, Blackboard facilitated this international collaboration and produced some very high quality reports from the students.

### *Fieldwork Study #2*

Although there were some problems identified the authors learned a lot from the

first fieldwork study, and findings are now being used to refine and repeat it this year. For example, the timeline of the project has been adjusted to reflect the various holidays in the three countries. Because it seemed as if the commitment of the students to the project was linked to the percentage of his/her final course grade, the weighting of this project at the various institutions has now been adjusted. Using a common rubric for assessment in the first fieldwork study worked very well and the evaluations, which were independently done, correlated very nicely (there was overall agreement in all but one instance) so the same approach to assessment is being adopted.

However, in the second fieldwork study, although students were still allowed to choose their partners, each of the groups was established by the tutors on the basis of the Belbin (1981) Self-Perception Inventory that requires individuals to determine their perception of their own group behaviour.

After completing this Self-Perception Inventory, students were classified according to one of eight roles: Chairperson, Shaper, Monitor/Evaluator, Team Worker/Builder, Company Worker/Implementer, Resource Investigator, Completer/Finisher or Plant. Belbin gives descriptions of each of these roles that include typical features together with positive qualities and allowable weaknesses. Belbin's research indicates that identification of these team roles, based on Intelligence, Dominance, Extroversion/Introversion and Stability/Anxiety factors, can then be used to construct balanced teams.

Thus the underpinning rationale for using the Belbin inventory was to try to establish effective and balanced 'virtual' teams by bringing together people with individual differences who have the variety of requisite skills needed for group work. Based on the first fieldwork study's results, the authors also saw a need to establish some more focused parameters. To this end, students were asked to develop a strategy for achieving the required coursework deliverable and to set-up milestones. It was, therefore, also anticipated that having undertaken the Belbin Self-Perception Inventory, students could organise themselves and develop their strategy according to the team roles. That such reflection had been undertaken was subsequently evidenced in the strategies and clear allocation of tasks that were developed by the students.

The intention now is to categorise the postings made by each individual student in order to quantify the number of Triggering, Exploration, Integration and Resolution types of messages that they have made as per the Garrison *et al.* (2001) cognitive presence model used in the first fieldwork study. Once this has been done, each individual's pattern of message posting will then be mapped to their perceived Belbin behaviour in order to identify whether or not there is any correlation between the two and the impact that this might have for collaborative learning. While such an evaluation will be undertaken once the students have submitted their assignments preliminary findings indicate that the groups are working better than they had in the first fieldwork study and we expect this to be reflected in the cognitive presence scores of individual students.

## Conclusions

The advantages of a multi-institutional collaboration for students, working in virtual

teams to solve moral dilemma case studies, were demonstrated in the first fieldwork study both through student achievement as well as their reaction to it. Indeed, some specific advantages of using the Blackboard CLMT have already been identified including management tasks such as forming groups, selecting topics and identifying slots for tutorials and presentations, which have been significantly eased. Ease of communication between instructor and student was greatly enhanced. Inter-group and intra-group collaboration took place and the system enabled these to be observed by the instructor, who could join in the discussions as required.

Despite some initial problems students were positive in their feedback and the academic grades seemed to reflect that this approach had merit. However, the successes and failures of the virtual teams led the authors to investigate ways, other than random assignment, of setting them up. Exploration in the literature led them to the Belbin Self-Perception Inventory as a tool to create more balanced teams. They applied it in establishing the global virtual teams. The current field study, although incomplete, is already showing a marked improvement in the functioning of teams and in the type of communication as measured by cognitive presence (Garrison *et al.* 2001).

### Notes on contributors

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JOE GRIFFIN has been researching into computer supported collaborative learning in a multi-institutional context for some years now. He is currently exploring a multi-cultural perspective to this research involving students from Asian and European universities in collaborative learning.

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