

Selection and Use of a Web Based Collaborative Learning Management Tool to Teach Professional Issues

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ABSTRACT

Professional Issues in Software Engineering (PISE) is a final year undergraduate module for computer science students that focuses on the legal, ethical and social aspects of computing. The ethical strand of this module, which aims to develop moral reasoning in the learners, has in the past proved to be the most difficult for students to grasp. Recent research indicates that working in groups can contribute to the development of moral reasoning[1]. However, group work also brings with it problems of identifying and assessing individual contributions [2].

During the current academic year a commercially available collaborative learning management tool (CLMT), Blackboard, has been used to enable a large cohort (130 students) to be taught and assessed using a group based approach.

This paper applies a framework [3] to identify suitable tools and examines the use of this CLMT in teaching PISE. It gives details of the different facilities offered by the system, an analysis of how these were used and some reflections on the strengths and weaknesses of Blackboard.

KEYWORDS

collaborative learning tools, computer ethics, moral reasoning, teaching/learning

1. INTRODUCTION

Professional Issues in Software Engineering (PISE) is concerned with the ethical, legal and social issues surrounding the design, implementation and use of computer and information systems. The main aim of this module is " ...to encourage students to develop the ethical foundations of good professional practice in computing." (<http://www.csis.ul.ie/>). A major theme is the relationship between ethics and the legal

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and social consequences of being a computer professional. In order to achieve this the module uses a group learning approach to help students to develop moral reasoning.

The module starts with a series of core lectures where students are introduced to the main concepts in this area. These focus on an introduction to ethical theories (ethical relativism, utilitarianism, deontological theories) the dialectical process, legal issues and social consequences (gender & access issues). Students then undertake a group based presentation and produce a written report based on a moral dilemma scenario.

In the current academic year there are 130 students in the cohort and this has raised significant management and pedagogical issues. For example how does the tutor ensure that students are working towards developing the concepts of personal and professional codes of ethical conduct (the dialectical process)? Are higher order learning outcomes [4] being achieved? How can individual students be assessed fairly using group work? How can weaker students be identified early enough to enable appropriate intervention?

In previous years with smaller cohorts it was relatively easy to monitor individual progress even though students worked in groups. Larger cohorts have meant more groups and this approach to learning and assessment has become significantly more difficult to maintain.

2. HIGHER ORDER LEARNING OUTCOMES

Bloom's hierarchy of learning objectives (Bloom op cit) identified six levels of learning which represented increasing levels of cognitive complexity from the lowest level of Knowledge (or remembering) through Comprehension, Application, Analysis, Synthesis and Evaluation. Learners can demonstrate learning at the higher levels by the achievement of higher order learning outcomes associated with particular modules of study.

Anderson and Krathwohl [5] have developed a hierarchy, which is a modification of that of Bloom et al. There are still six levels but these are now identified by use of a matching verb. The verbs that describe the increasing levels of cognitive complexity are: – Remember, Understand, Apply, Analyse, Evaluate and Create

As a main aim of PISE is "to develop the ethical foundations of good professional practice in computing" it could be argued that this can be best demonstrated by achievement of the three higher learning levels. Anderson and Krathwohl (op cit) have defined these as follows:

Analyse - encompassing differentiating or distinguishing, organising or structuring, and deconstructing (which concerns determining the values underlying presented material).

Evaluate - which breaks down into the two processes of checking for internal consistency, and critiquing which involves judging against external criteria.

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Create - which involves generative processes such as hypothesizing, planning, designing, and producing or constructing.

By using a collaborative learning environment it was intended that learners would be encouraged to analyse a moral dilemma, evaluate different moral solutions and create a personal moral code of practice.

3. COLLABORATIVE LEARNING - EFFECTS AND PROBLEMS

There has been much research into the effects of collaboration in the teaching/learning process in a number of disciplines and with students of differing ages and experience. There is also research evidence to suggest that in the area of ethical education collaborative learning contributes to cognitive moral development. This section briefly reviews some of this research.

Salomon [6] has pointed out that for collaborative learning to provide long term effects it should intellectually engage the learners, encourage personal responsibility and provide real interdependence between the necessity to share information, the division of labour, and the need for joint thinking in explicit terms that can be developed and changed by peers. Fjuk et al (op cit) argue that an effective collaborative learning environment must stimulate this mindful engagement and social interaction. Dillenbourg [7] has pointed out that the necessity of having to share information meanings, concepts and conclusions is inevitable in the collaborative construction of knowledge. Furthermore, collaboration with other students has been shown to stimulate activity, make learning more realistic, and to stimulate motivation [8]. The collaborative approach to learning, supported by instructional technology, also appears to lead to deeper understanding and new knowledge creation ([9, 10, 11]).

Research has also shown that moral dilemmas in computer ethics encourage group discussion [12], that teamwork encourages social facilitation, better learning and higher cognitive skills [13, 14] and that groups can produce better solutions to moral and ethical problems than individuals [15]. Research in the area of pharmaceutical education (Latif, op cit) has also shown that peer discussions of moral dilemmas facilitates the development of moral reasoning.

At the same time there is a major problem with the use of group-based approaches in teaching. This is primarily due to the possibility of some individuals gaining more from the process than they have input, a term that has been called 'free-riding' (Shepperd, op cit). Although research also suggests that groups need to be large to increase the advantages to members, this often increases the occurrence of free-riding due to the difficulty of monitoring large numbers of students. (Veerman & Veldhuis-Diermanse, op cit).

In order to overcome the problems managing larger cohorts and to ensure that the advantages of collaborative learning were maintained, it was decided to investigate the use of a collaborative learning management tool in this module.

4. SELECTING THE CLMT

There are a number of web based collaborative systems available in the education field which have grown out of research into CSCW. Bentley et al [16] have identified a number of advantages of these tools:

- they are platform independent
- access is geographically independent
- web browsers are now commonly available on most computers
- there are generally quite high levels of literacy when it comes to using this type of tool
- many of these tools allow both synchronous and asynchronous collaboration

Research has also shown that asynchronous tools can provide student groups with more options to think and reflect on information, to organise and keep track of discussions and to take part in group discussions compared to synchronous tools (Veerman & Veldhuis-Diermanse, op cit).

In order to provide the best pedagogical solution with the tool selected a framework for the evaluation of web based collaborative systems developed by Fjuk et al (op cit) was used. This framework uses Salomon's (op cit) three interconnected elements:

- production/knowledge construction
- information sharing
- division of labour

The framework also considers both interactional and operational aspects using Vygotsky's [17] perspectives. The interactional aspect focuses on the way knowledge is constructed both individually and collaboratively. On the operational level the aim is to identify tools that enable the learner to achieve a specific outcome while at the same time remaining transparent in their work.

The following tables are based on this framework and relate the interactional and operational aspects to the individual Blackboard tools.

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<i>Interactional examples</i>	<i>Operational examples</i>	<i>BB tool</i>
Searching for information	Digital libraries	Learning communities
Constructing a personal domain of knowledge	Mechanisms for constructing personal domains	Discussion boards
Articulating meaning into information objects (text, hypertext, notes etc)	Mechanisms for articulating thoughts	Discussion boards, emails, personal web pages, file exchange
Producing and distributing information objects	Mechanisms to down(up)load objects	Email attachments, file exchange, Discussion boards postings
Distributing and co-ordinating meanings to peers	Mechanisms for attaching information objects	Email, Discussion boards postings, file exchange
Reflecting upon and elaborating on existing information objects	Mechanisms for making notes Threaded discussions	Discussion boards
Planning progress	Mechanisms for personal planning	Calendar
Identifying roles and tasks	Mechanisms for allocation of roles	Discussion boards
(Re) evaluating own knowledge and interpretations	Self-evaluating tools	Discussion boards, Whiteboard

Table 1 - Production/knowledge construction

<i>Interactional examples</i>	<i>Operational examples</i>	<i>BB tool</i>
Distributing and co-ordinating information objects amongst peers	Mechanisms that retrieve information from social interactions Mechanisms that retrieve lists of all actors in the social communities and other actors in the system	email, Group Whiteboard, Group discussion boards
Commenting on information objects provided by peers	Mechanisms that inform which actors are online Synchronous and asynchronous mechanisms	Group discussion boards, Group Whiteboard, Tutornet
Making common decisions	Synchronous and asynchronous mechanisms Voting mechanisms Decision support	Group discussion boards, Group Whiteboard, Tutornet - limited
Co-producing/co-authoring information objects	Mechanisms to retrieve whole dialogues with contributions before and after that specified by actor	Group discussion boards Tutornet log files
Maintaining overview of peers' actions and progress	Dialogue searching Categorising dialogue items	Limited in Group discussion boards
Creating a common presentation area	Mechanisms for producing joint information objects	Group discussion boards, Group Whiteboard, Group pages
Creating learners' content annotations	Mechanisms for categorising dialogue items according to keywords	none

Table 2 - Information sharing/joint construction

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<i>Interactional examples</i>	<i>Operational examples</i>	<i>BB tool</i>
Organising the group/project	Mechanisms for producing joint information objects	Group discussion board, Whiteboard, Group pages
Articulating responsibility and commitments	Minutes of meetings and decisions taken	Group discussion board, file exchange
Articulating time for meetings etc	Mechanism for using joint calendar facility	Calendar, Group discussion board
Making common plans using responsibility/milestone charts	Project management tools	Calendar
Maintain awareness of how particular activity fits into individual's knowledge & progress	Mechanism for retrieving an overview of individual's status	Discussion board - limited
Maintaining awareness of learner's interaction with collaborative environment	Mechanism to count number of interactions	Discussion board - limited Control panel - tutor

Table 3 - Division of labour

As can be seen from the above tables nearly all of the interactional examples cited in this framework can be operationalised using one of the Blackboard tools. However, in some cases the tools provided only offered a limited operational functionality.

5. HOW THE BLACKBOARD SYSTEM WAS USED

The system was used over a thirteen week period by a student cohort of 130 and two module tutors. There were approximately 33700 hits in total over the entire period.

These can be categorised as follows:

- management - self-organisation students into groups, selection of topics, tutorial times and presentation times
- accessing learning materials and external links
- communication
 - lecturer to student
 - student to lecturer
 - student to student
- intra-group collaboration using self-regulated discussion groups.

Table 4 gives a breakdown of the levels of use of the four functional areas of Blackboard

Function area	Hits	%
Content	15904	47.1
Communication	10229	30.34
Groups	7340	21.65
Student tools	239	0.8
Total	33712	

Table 4 - Functional use of the Blackboard system (includes 4.5% for visits by tutors)

As can be seen, accessing content constituted the single highest activity of use of the CLMT. However, communication between students and between students and tutors and well as usage of the group tools, which were also primarily for communication, accounted for approximately 52% of Blackboard use.

Blackboard Area	Hits	%
Main Page *	9584	60.2
Course Information	1039	6.53
Staff Information	815	5.12
Course Documents	2280	14.3
Assignments	1386	8.71
External Links	800	5.03

Table 5 - Access levels - * As the main page was accessed each time a user logged in this figure does not necessarily indicate any useful contribution to the learning situation.

Table 5 shows the levels of access to different parts of the Blackboard CLMT. These areas were accessed for both management and educational content.

Area	Hits	%
Send Email	80	0.78
Student Homepages	1	0.00
Group Pages	6957	68.0
Posted Discussion Message	2776	27.1
Virtual Chat Room	113	1.10
Student Roster	302	2.95

Table 6 - Communication usage

Table 6 shows the levels of usage of the tools. The Posted Discussion Message refers to messages posted to the main discussion board, which was accessible, by the entire cohort. This was used primarily for management issues (self-organisation of students and groups, selection of topics, tutorial and presentation times etc.). This type of use decreased as these management issues were resolved. Group Pages, the most heavily used area, was primarily used for collaboration on the assessment tasks. The Group Pages tools became more used as the module progressed with peaks occurring before groups had to submit the scenario report or give a presentation. Further discussion of these follows.

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The Student Tools section was least used, as there were relatively few features here that were needed to successfully complete this module. None of the student tools feature in the list of operational examples in the framework used to select the CLMT.

6. COLLABORATIVE LEARNING WITH GROUP PAGES TOOLS

A specific requirement of the module was for each group member to investigate an aspect of a moral dilemma scenario and to then discuss their findings with the rest of their group. This individual/collaborative work was carried out by students using tools provided from the Group Pages (Fig 1).

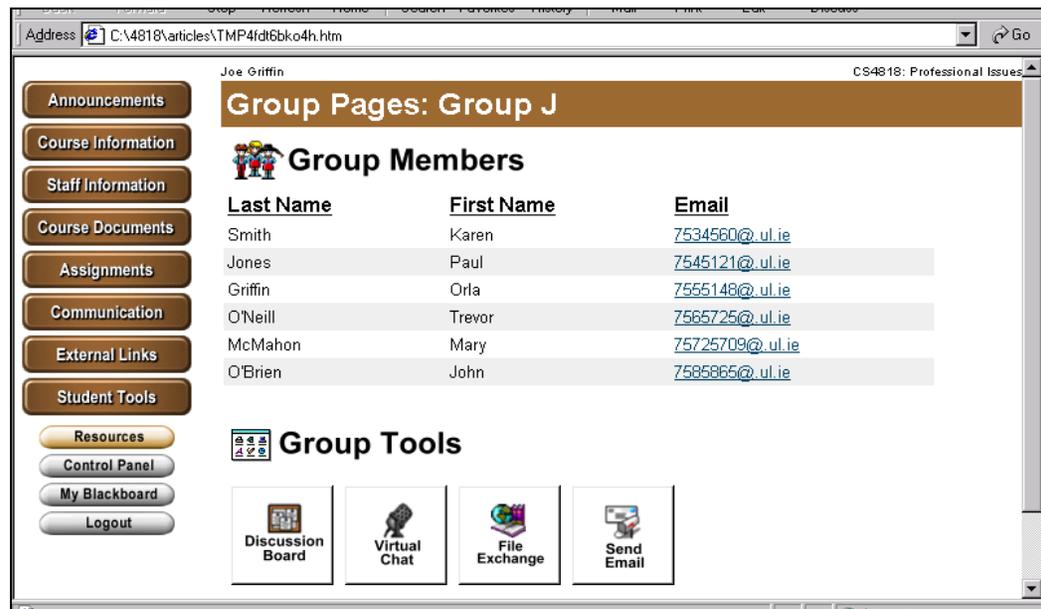


Figure 1. Group pages (identities have been changed)

Fig. 1 shows the Group Pages main screen. Access to all other parts of the Blackboard CLMT is available using the buttons on the left side. Specific Group tools are accessed using the buttons along the bottom of the screen. Group members are listed in the main area. Only members of a particular group and the module tutor could access a group's tools.

The Discussion Board tool provided asynchronous communication and the Virtual Chat tool provided the synchronous communication facility. Students could swap files and send emails to other group members using the File Exchange and Send Email tools. Of the four tools available, the Discussion Board was by far the most used.

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Tool	Hits	%
Group discussion board	6844	93.26
Send Group Email	121	1.64
Send File to Group	107	1.45
Group Virtual Chat	268	3.65

Table 7 - Details of usage of group area tools

7. ANALYSIS OF GROUP DISCUSSION BOARD USE

Early analysis of usage patterns indicated that the majority of postings elicited no replies and did not grow into threaded discussions. It also became obvious that a number of students in the cohort did not use threaded discussions appropriately. Some postings that should have been in reply to earlier postings were submitted under new headings, others which introduced new topics were wrongly submitted as part of ongoing threaded discussions. It is not clear if this demonstrates a lack of ability in the dialectical process but feedback from students indicates that correct usage of asynchronous tools such as this needs to be formally taught

Following the completion of the PISE module a content analysis of usage was carried out. Students were also asked to provide feedback on Blackboard as part of the normal module evaluation.

The content analysis of the group discussion boards showed that approximately 62% of postings did not develop into threaded discussions. This is consistent with other recent research of the use of asynchronous communication tools in higher education [18]. One possible reason for this, cited by students early in study, was their preference for face-to-face communication. However, the educational value of such unstructured discussions is of some doubt. It is also difficult to assess individual contributions. One option, which might overcome this, is to use larger groups of students or to involve students from other institutions who are carrying out similar assessment tasks in similar modules.

As neither of these was feasible within this study 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 written report individual contribution already had to be indicated clearly. For the threaded discussions, postings could be ascribed to individuals thus enabling measurement of individual contribution.

Approximately 30% of groups elected to submit discussion board content for assessment. It is worth noting that the discussion board tool was also used by groups submitting written reports for some intra-group communication, albeit not to the same extent.

At the end of the semester the module was evaluated using an anonymous questionnaire and student views on the use of Blackboard were sought. 53 students responded and their

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responses were categorised as either positive or negative. Three responses contained elements of both so were excluded.

Overall 30 respondents submitted positive comments about the Blackboard CLMT and 20 submitted negative comments. Positive comments included the following:

"...helped with communication within the group"

"...kept a good list of all the discussion we had for future reference"

"...gives you the chance to express your opinion without fear of humiliation because it is only viewed by 6 people"

"...a very valuable tool for cooperating on projects"

"... useful for the scenario, as ideas can be developed on it"

Negative comments were focused on the necessity for such a tool in groups that saw each other on a regular basis.

"...our group... found face to face meetings were far better for getting our points across"

"...more useful... to students who don't have face to face contact"

In general, students found it challenging to have use this approach and also indicated that it made them think more deeply about their own contributions before actually posting a message to the discussion board.

8. CONCLUSION

Overall, the use of the Blackboard CLMT has been successful. Students have seemed to be more engaged in the module and average grades for this academic year (albeit a crude indicator) are higher than for previous years. Future research will use specific tools (e.g. the Defining Issues Test [19] or the Moral Judgment Test [20]) to more accurately measure the contribution of this pedagogical approach to the development of moral reasoning.

The CLMT has also contributed to the management and teaching of a large cohort of students. Management of the module including the formation of groups, topic selection and identification of slots for tutorials and presentations was significantly eased. Communication between lecturer and student has been greatly enhanced with the use of the discussion boards.

The CLMT enabled the tutor to see the number and level of contributions made to various discussion boards, measure individual contributions and identify students needing early intervention.

However, both students and the module tutor also identified some problems. The volume of usage was much greater than was anticipated and due to the number of levels in the system (e.g. to get to a group's discussion board requires the traversal of five levels,) considerable time needs to be spent to ensure that peers and/or the tutor answers all communications in a timely manner. A flagging or notification system would improve

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this. Student use of the discussion board tool and threaded discussions in a way that will enhance their learning experience has also been problematic.

Some students expressed a preference for face-to-face communication. However the problems with this type of communication are that individual contribution to group work can be difficult to assess and that this type of communication can be unfocused, compared to the use of written communication. One way to encourage use of this technology was to encourage discussion board postings as the format for submitted work.

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