

USING COLLABORATIVE LEARNING TOOLS IN A MULTI-INSTITUTIONAL APPROACH FOR TEACHING PROFESSIONAL ISSUES

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ABSTRACT

Collaborated learning management tools (CLMT) were used as part of the teaching and assessment process with a cohort of computer science students from three universities in Ireland, England and the USA in the area of professional issues (the legal, ethical and social aspects of computing). Students in the cohort used asynchronous communication tools to work in virtual groups to solve a moral/legal dilemma case study. They were originally assessed on a written report based on the content of their postings to a discussion board. Subsequently a framework for the assessment of critical thinking developed by Anderson et al (2001) was used to analyse the discussion threads produced by the same learners. This paper describes the nature of this study, discusses the use of computer-mediated communication (CMC) in the teaching and assessment of professional issues and reflects on the possible links between the use of CLMT in a collaborative learning situation and the development of higher order critical thinking skills in tertiary level students.

KEYWORDS

Collaborative learning, critical thinking, computer ethics.

1. INTRODUCTION

The development of critical thinking skills is one of the main objectives of university level education. One reason for teaching computer ethics, it could be argued, is that it is a way in which critical thinking can be developed. But there is a perennial question of how to measure whether the pedagogical methods adopted contribute to this development. It has been argued (Sotto, 1996) that what constitutes 'good teaching' in higher education is not well understood and how it relates to students' learning is a complex issue.

One method, which is often used, is the traditional essay/report where students are expected to provide evidence that they have met the learning outcomes for a particular unit of study. These learning outcomes are normally produced based on a specific taxonomy. For example, Bloom's hierarchy of learning objectives (Bloom et al, 1956) 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. Specific assessment tasks are then produced to measure the level of success students have in reaching particular learning outcomes.

In this study a different assessment method was used, namely getting students to work together in virtual groups using a collaborative learning management tool and then to produce an written report based on a moral/legal dilemma. There were a number of reasons for adopting this pedagogical approach.

At the University of Limerick (UL) an increasing numbers of students taking this module (130 in the last cohort) 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 (Bloom et al 1956) being achieved? Are learners developing critical thinking skills? Does the use of asynchronous communication as opposed to synchronous communication (e.g.chat rooms) encourage reflection.

However, a major driving force for the idea of international collaboration was the fact that students who had worked previously at UL in virtual groups did not feel they were involved in an authentic learning process. Feedback from an earlier study (Griffin 2001) indicated that the use of a CLMT would be more realistic if it actually allowed students who were not geographically co-located to work together.

In an attempt to deal with these concerns a Collaborative Learning Management Tool, Blackboard (www.blackboard.com) was used as part of the teaching/learning process.

2. MULTI-INSTITUTIONAL APPROACH

The study involved students from three institutions, University of Limerick in Ireland (UL), de Montfort University in England (DMU) and Sacred Heart University in the USA (SHU). It is the author's understanding that this is the first time a multi-institutional collaborative learning project in the area of computer ethics has been undertaken.

All three institutions offered a similar course to final year undergraduate students focusing on the ethical, legal and social implications in the design and use of computer systems. Central to the pedagogical approach adopted in all three colleges had been the use of group work in the teaching/learning process. The importance of working collaboratively is discussed below.

All three modules were similarly structured. Following a series of core lectures, where students are introduced to the main concepts in this area, students produce a group based written report based on a legal/moral dilemma scenario as part of their assessment. Throughout the module students meet face to face with module tutors in a tutorial setting as well as collaborating using synchronous and asynchronous tools. However, groups could only operate as functional units by meeting 'virtually'.

Due to there being smaller cohorts of students at DMU and SHU it was only possible to have seven groups in this study and it was decided that the groups would be comprised of 2 students from each institution. Students were told in advance that their postings would be analysed and their agreement to take part in this study was gained before the project began.

3. COLLABORATIVE LEARNING AND ASSESSMENT

The use of a problem based collaborative teaching/learning strategy has been shown to help develop deeper understanding of subject domains (Dukerich et al, 1990). Research also shows that teamwork encourages social facilitation, better learning and higher cognitive skills (Hiltz, 1994). As part of this module students have to work in groups to produce assessed solutions to a legal/moral case study.

One reason for assessing this part of the learning experience was to provide motivation to students to work collaboratively. As Fahraeus et al (1999) state "teachers motivate students to contribute ... by giving them credit for contribution". Students in this study were given a percentage of the total marks for individual contribution as well as achieving a grade for the group work.

Research has also shown that deeper understanding of moral dilemmas can often occur by working collaboratively (Peek et al, 1994) and that the collaborative approach to learning, supported by instructional technology can lead to deeper understanding and new knowledge creation. (Mäkitalo et al. 2001, Cravener, 1999, Harasim et al, 1995).

There are also practical advantages to using CMC, as it is easier to measure individual contributions than in face-to-face situations because an audit trail is created. This in turn makes it easier to deal with situations where some individuals gain more from the process than they input, a term that has been called 'free-riding' (Shepperd, 1993), as individual contributions can be identified.

4. COMMUNITY OF INQUIRY

Garrison et al (2001) have proposed a model, the Community of Inquiry as a "framework for analysing critical thinking in computer conferences". Using this model "deep and meaningful learning, ostensibly the

central goal of higher education, takes place in a community of inquiry composed of instructors and learners as the key participants in the educational process". The model proposes that by the interaction of three elements this learning takes place. These elements are social presence, teaching presence, and cognitive presence.

Teaching presence, focuses on the design and management of learning sequences, provision of subject matter expertise, and facilitating active learning. It does not refer the 'teacher presence' as the learners themselves can provide some of the foci.

Social presence is defined as the ability of learners to project themselves socially and emotionally in a community of inquiry. Garrison et al (ibid) describe this element as "having the function of supporting the cognitive and affective objectives of learning" Cognitive objectives are support by social presence "through its ability to instigate, sustain, and support critical thinking in a community of learners" while affective objectives are supported by "making the group interactions appealing, engaging, and thus intrinsically rewarding" which can lead to a more successful completion of units of study by getting the learner to become more involved in the whole process.

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."

The research group which has proposed this model argues that it is a framework that can be used to analyse the effectiveness of CMC in "supporting critical thinking in higher education" Archer et al, (2000).

The application of the framework was used in this study in the analysis of cognitive presence to examine whether there is a link between use of the CMC and the development of critical thinking.

5. THE BLACKBOARD SYSTEM

The Blackboard (www.blackboard.com) Collaborative Learning Management Tool (CLMT) is an integrated set of web-based tools designed for the creation, management and use of a learning environment. Using the tools provided the following facilities: publication of learning materials (including links to module related websites); publication of announcements; collaboration using bulletin boards and chat rooms; communication tools such as email.

This tool enables a tutor to build up a course site with different types of learning materials. The tutor can also 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(s) either synchronously or asynchronously

Analysis of usage of the available tools following the completion of the module showed that the majority of users made most use of the collaborative part of the system. Table 1 shows the functional areas of the Blackboard system with the level of usage for each. (Note:usage is measured by the number of page hits and recorded automatically by the statistical analysis part of the Blackboard system.)

Table 1. Functional use of the Blackboard system

Function area	%
Content	47.1
Communication	30.34
Groups	21.65
Student tools	0.8
Total	

The Content functional area gives the level of use for accessing learning resources. The Communication and Groups functional areas show levels of use for cohort wide and group communications Student tools, such as the facility to create personal web pages were almost totally unused.

Within the Groups functional area four tools were available to users. Table 2 below shows the level of use of these tools and it can be seen that over 70% was for the group discussion board tool. Analysis of the postings to these boards is discussed in the next section.

Table 2. Details of usage of Group Pages tools

Area Name	%
Group Pages	15.61
Group Discussion Board	70.09
File Exchange	2.11
Email	0.66
Virtual Chat	Unused

6. ANALYSIS OF COGNITIVE PRESENCE

There are four categories in the cognitive presence element within the model of critical thinking and practical enquiry proposed by Garrison et al (2000) for the analysis of critical thinking. These are: triggering events, exploration, integration and resolution. (There is a fifth category to represent non-cognitive interactions such as arranging meeting times etc. This was not used in this study.)

Each category is defined using a set of descriptors. The following table shows the categories, their descriptors and indicators.

Table 3. categories for analysis of cognitive presence in community of inquiry

Category	Descriptor	Indicator
Triggering events	Evocative	Recognising the problem
		Sense of puzzlement
Exploration	Tentative	Divergence within community
		Divergence within single message
		Information exchange
		Suggestion for consideration
		Brainstorming
Integration	Provisional	Leaps to conclusions
		Convergence among group members
		Convergence within single message
		Connecting ideas - synthesis
Resolution	Committed	Creating solutions
		Vicarious application to real world solutions
		Defending solutions

Before using these four categories to analyse the data a further consideration needed to be given to the unit of analysis. This can be defined as the discrete element of data that enables text to be identified, categorised and recorded for analysis and there are a number of possible levels which can be used from syntactical units such as phrases, sentences and paragraphs to thematic units. Garrison et al (ibid) identified that the most appropriate unit of analysis was the messages 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 syntactical unit". In this study I have used the same unit of analysis.

6.1 Examples

Triggering

I think this is important, as it states exactly what we need to focus on... but I can't figure out the implications of this... please help! Do we just consider the situation BEFORE the bug was fixed?

Exploration

In the ten commandments on Computer Ethics by the Computer Ethics Institute, the following is rule number 7.

"Thou shalt not use other people's computer resources without authorization or proper compensation."

In the Scenario would this imply that the consortium were unethical as they made amendments to Entwhistle's product without authorization? What do you all think?

Integration

Okay, let me explain. Firstly to recap, what exactly is a patent?

"A patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something, or offers a new technical solution to a problem."

Resolution

So far, this is how I have interpreted this thread...

We all agree that the consortium modified and distributed Entwhistle's patented product and as such they did break the patent. BUT we are arguing that the exception quoted above protects the consortiums actions and hence no breach legally took place.

7. RESULTS

Seven groups of students from the three institutions were established with 6 members in each. Each group submitted a written report for assessment based on the contents of the threaded discussions. Table 4 below gives details of each group's postings and the mark awarded for the written report.

Table 4. Analysis of postings

Group	Triggering	Exploration	Integratation	Resolution	Total Posted	Mark awarded %
1	3	28	36	7	75	60
2	3	21	51	7	82	78
3	5	35	54	18	112	75
4	1	12	8	1	22	50
5	3	8	3	0	14	36
6	6	31	9	10	38	56
7	10	22	13	3	48	52

The first column in shows the group numbers. This is followed by four columns indicating the number of each type of posting that were submitted for each group using the categorisation proposed by Garrison et al (ibid). Then the total number of postings for each group is shown. The final column in Table 4 shows the mark the groups were awarded for the legal/moral dilemma case study report. The scoring rubric for this is shown in Appendix A. Marking was carried out independently by each of the tutors and following some minor adjustments the marks listed above were agreed.

The data shows a broad correlation between the marks awarded and the occurrences of messages in the integration and resolution categories. Groups who received higher grades in recognition of their problem analysis and solution were assumed to have achieved higher levels of critical thinking. The results of the analysis of cognitive presence, and particularly the occurrence of messages in the integration and resolution categories, appears to correlate with the original marking scheme and points to the fact that there is a link between the use of this collaborative approach and the development of critical thinking skills. However, it is not clear that there is a definite correlation between the types of postings and the overall mark awarded by the tutors.

8. CONCLUSION

The data collected in this study appears to go some way to supporting the hypothesis that working collaboratively in virtual groups can contribute to the development of higher order critical thinking skills as measured by the Cognitive Presence framework. However in order to confirm this a further study is planned where the Moral Judgment Test (Lind 2001) will be used to measure improvement in moral reasoning and to examine what, in any, correlation might exist between this and the types of messages posted to the discussion boards as analysed using the cognitive presence measure.

During the study some other advantages of using the Blackboard CLMT were also been identified:

- Class management. The onus of forming groups, selecting topics and identifying slots for tutorials and presentations has been significantly eased. Posting of paper topics and reading questions were timely as were threaded discussions.
- Communication between instructor and student was greatly enhanced with the use of the discussion board and course announcements
- Inter- and intra-group collaboration took place and the system enabled these to be observed by the instructor, who could join in discussions as required
- The virtual chat tool enabled virtual tutorials to take place thus facilitating involvement for students who had difficulty always attending on campus.

However, these were some of the problems that were encountered:

- Participants were attaching all their documents until they learned to use the file exchange.
- Some participants wanted synchronous communication using Chat, which was difficult because of the time differences.
- If participants used instant messenger, it was impossible for the instructors to know this or to track the groups, so its use was discouraged.
- Different school holiday schedules

Father research is currently being carried out with a multi-cultural element. In this study students from non-western cultural backgrounds are also part of virtual groups. It is hoped that by the IADIS International Conference e-Society date further results will be available from this study. The author is also anxious to work with students and faculty from Asian institutions.

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Appendix A

Scoring Rubric

Objective	Unsatisfactory	Satisfactory	Meets Expectations	Above Average	Exceeds Expectations
Students will be able to demonstrate effective communication skills and solid ethical reasoning: Writing ethics papers	<=39%	45%	55%	65%	75%
Purpose <ul style="list-style-type: none"> ▪ <u>Focus</u> ▪ <u>Significance</u> (shows an awareness of main ideas) • <u>Assignment topic</u> 	Objective not clearly stated, paper lacks central focus Lack of awareness of main ideas or wrong interpretation of main ideas Doesn't write on topic	Satisfactory attempt at stating the objectives and focusing the paper. Covers basic subject matter adequately but insufficiently analytical. Some irrelevancies/ omissions evident	Objective adequately stated paper has central focus Some awareness of main ideas and some critical analysis Mostly sticks to assigned topic	Objective clearly stated, paper has good central focus Good awareness of main ideas. Clear evidence of critical judgment Meets all assignment criteria	Objective very clearly stated, paper has strong central focus An authoritative grasp of the main ideas, significant originality and insight Exceeds all assignment criteria, giving significant originality and insight
Discussion Contributions <ul style="list-style-type: none"> ▪ <u>Structure</u> (Individual Postings) ▪ <u>Coherence</u> (Group Discussion) ▪ <u>Paragraphing</u> (transitions f/one idea to next) (Group Discussion) 	No clear structure or pattern to contributions. Irrelevant postings that do not add to/further the debate. Entire discussion lacks clarity; story lacks coherence overall. Lack of transitions between ideas	Covers the basic subject matter adequately and is appropriately organised. Attempts to further the debate. Some limitations in the ability to select and present relevant material in a coherent way. Some attempt at transitions between ideas posted	Adequate structure or pattern evidencing ability to structure and organise arguments. Adds to the debate and evidences some individual reading and research. Discussion is generally clear; coherent overall Adequate transitions showing some evidence of extending the discussion	Clear evidence of critical judgment in selecting, ordering and analysing content. Good contribution to the debate supported by relevant references. Discussion demonstrates some ability to synthesise material. Good transitions evidencing good awareness of the issues to be addressed and the contributions of the group	Clear structure or pattern. Material synthesised effectively. Excellent contribution to the debate fully supported by relevant references. Entire discussion is very clear; story is very coherent Excellent transitions evidencing thorough research and critical evaluation of group contributions.

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<p>Organization</p> <ul style="list-style-type: none"> ▪ <u>Audience</u> ▪ <u>Introduction and Conclusion</u> 	<p>Inappropriately targeted.</p> <p>No clear Intro and/or Conclusion</p>	<p>Some awareness of audience evidenced.</p> <p>Satisfactory attempts at providing an Introduction &/or Conclusion</p>	<p>Guides reader</p> <p>Clear Introduction &/or Conclusion provided</p>	<p>Shows a good awareness of audience</p> <p>Good Introduction & Conclusion that reveal insight and some originality</p>	<p>Knows audience</p> <p>Strong Introduction & Conclusion evidencing critical/analytical thinking</p>
<p>Evidence</p> <ul style="list-style-type: none"> ▪ <u>Accuracy</u> (statements) ▪ <u>Support</u> (opinions are adequately supported) ▪ <u>Documentation</u> ▪ <u>Counterarguments</u> ▪ <u>Social/Ethical Analysis</u> 	<p>Sources are inadequate Inaccurate statements made.</p> <p>Lack of support for statements/opinions</p> <p>No sources identified in the body</p> <p>Missing counterarguments</p> <p>Doesn't make use of ethical & social analysis and theories</p>	<p>Sources adequate. Some minor inaccuracies.</p> <p>Satisfactory attempt to support opinions</p> <p>Some sources are identified and referenced appropriately in the body</p> <p>Counterarguments presented but not fully analyzed</p> <p>Minimally & unconvincingly uses ethical & social analysis and theories</p>	<p>Most statements are accurate.</p> <p>Adequate support for statements/opinions</p> <p>Most sources are identified and referenced appropriately in the body</p> <p>Counterarguments presented,</p> <p>Makes good use of ethical and social analysis and theories</p>	<p>Statements are very accurate</p> <p>Good support for statements/opinions</p> <p>All sources are identified and referenced appropriately in the body</p> <p>Counterarguments presented and some analysis undertaken</p> <p>Uses ethical and social analysis and theories convincingly.</p>	<p>Statements are very accurate</p> <p>Strong support for statements/opinions</p> <p>All sources are identified and referenced appropriately in the body.</p> <p>Counterarguments strongly presented and analyzed</p> <p>Critically evaluates and uses ethical and social analysis and theories convincingly.</p>
<p>Mechanics</p> <ul style="list-style-type: none"> ▪ <u>Sentence structure</u> (grammar, sentence structure, spelling, punctuation) ▪ <u>Appearance</u> (Paper, References) 	<p>Many errors in grammar, spelling, and/or punctuation. Mechanics interfere with reader's understanding of the text</p> <p>Poor appearance of Paper, No References included or References incorrectly laid out.</p>	<p>Acceptable standard of grammar, spelling and punctuation.</p> <p>Acceptable appearance of Paper, References included and correctly laid out.</p>	<p>Few errors in grammar, spelling, and/or punctuation. Minimal distraction.</p> <p>Good appearance of Paper, References included and correctly laid out.</p>	<p>Good use of grammar, spelling, and punctuation. Clear mechanics.</p> <p>Very Good appearance of Paper, all References suitably included and correctly laid out.</p>	<p>Excellent grammar, spelling, and punctuation. Clear mechanics.</p> <p>Excellent appearance of Paper, all References presented in standard, consistent format.</p>

Comments: