

Collaborative Learning in a Web-mediated Environment: a study of communicative practices

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ABSTRACT New opportunities for conceptualising, designing and facilitating collaborative learning are rapidly expanding with the technological innovations and proliferation of web-mediated learning and teaching. By enabling social interactions via an electronic medium, web technologies are not only expanding but also transforming the social interaction space of collaborative learning. This paper explores collaborative learning viewed from these social interaction processes. More specifically, the paper applies a Communicative Model of Collaborative Learning to make sense of students' interactions in a management subject taught in a combined face-to-face and web-mediated mode. This model provides a methodological instrument for the analysis of communicative practices in concrete learning processes. By analysing the empirical data from linguistic interactions among students, the paper investigates not only what these interactions mean but also what they produce in a particular learning situation and how they affect learning. In particular, the paper investigates processes of knowledge co-creation that are integral to the development of capabilities for life-long learning.

Technological innovations and the proliferation of web-mediated learning and teaching are creating new opportunities for conceptualising, designing and facilitating collaborative learning. Students can work together, achieve shared understanding, and co-create knowledge in these new web-mediated environments. Such environments significantly support the development of life-long learning capabilities by those whose embodiment as both student and worker breaks down the now unsustainable binaries of student/worker and tertiary learning institution/workplace. For in designing web-based collaborative learning not only is delivery flexible, allowing workers to engage as students at any time or place, but also the curriculum itself is extended by drawing on the workplace experiences of the students engaged in reflecting collaboratively on theory and practice.

While numerous studies have addressed the comparative advantages and disadvantages of computer-supported or technologically-mediated learning versus traditional, face-to-face learning environments (Alavi, 1994) and their effects on discussion and student performance (Arbaugh, 2000a), there has been less emphasis on understanding the learning processes themselves from within these environments. During the rapid spread of technological developments, the case for web-mediated learning has been well advanced (Freeman, 1997) and many practitioners have reported designing, delivering/facilitating and assessing online courses utilising different computer-mediated communication tools (Bernat & Iijima Hall, 2000). Other studies, from the teachers' perspective, investigate how student learning processes and learning outcomes can be monitored and assessed using student web portfolios and software support (Chen et al., 2001). It has been argued how the teacher creates an interactive classroom environment is significantly associated with computer-mediated student learning (Arbaugh, 2000b). Other recent publications, such as Salmon (2000), contribute to practitioners' development of e-moderated environments created and shaped by both staff and students. Yet a focus on collaborative learning processes from the perspectives of student learners actively engaged within web-based discussion forums, as this study undertakes, is relatively recent. Thus the objective of this paper is to advance the understanding of web-mediated collaborative learning by investigating the communicative practices of learners and their resulting knowledge co-creation processes. Furthermore, this study may be seen in the context of Arbaugh's call (2000b, p. 10) for theory-driven empirical research into online learning.

This paper applies a Communicative Model of Collaborative Learning (Cecez-Kecmanovic & Webb, 2000a, 2000b) to analyse the linguistic interactions between students engaged in web-mediated learning in order to understand how their communicative practices develop and knowledge co-creation is produced. First, the pedagogical value of collaborative learning strategies and the challenges that student-centred learning poses in terms of repositioning learners and teachers is briefly reviewed. Second, the research setting for the empirical study of collaborative learning in a web-enhanced management subject for undergraduate student workers is outlined. Third, a Communicative Model of Collaborative Learning (CMCL) is discussed in terms of its assumptions, constituents and classification of linguistic acts. Fourth, using the CMCL an analysis of students' communicative practices on the electronic bulletin board is summarised. Next, the development of the collaborative learning space is traced. Then the productivity of the collaborative learning space is illustrated and closely examined in one set of student messages posted in the electronic forum during the subject. The paper concludes by raising some methodological and pedagogical implications.

Collaborative Learning Strategies

Collaborative learning strategies require more interaction and engagement between learners than do traditional methods (Rust & Gibbs, 1997; Topping & Ehly, 1998) and as such produce deeper learning of concepts, theories, and the co-creation of knowledge. Furthermore, collaborative learning strategies are more successful in developing generic skills valued in the workplace (Donaldson & Topping, 1996; Gibbs *et al.*, 1994), for example, communication skills, and those skills required to develop and participate in self-managed teams. If students are to become independent, life-long learners with competencies in the cognitive, social, and affective domains, then there is a significant pedagogical advantage in student-centred learning which focuses on experiential learning (Kolb, 1984) and collaborative interchange. However, the process of restructuring learning from teacher-centred to student-centred is critical (Spiller, 1998). Not only do content, process, and assessment require redesign but also students and teachers are repositioned. Web technologies and appropriate strategies offer new possibilities in such reorientation to active learning (Bonk & Dennen, 1999).

A Communicative Model of Collaborative Learning

The conceptual framework governing our empirical research is based on the assumptions that: (a) collaborative learning is performed and mediated by language; (b) collaborative learning is a process of social interaction; and (c) acts of communication or *language acts* function as social interaction mechanisms producing collaborative learning and knowledge co-creation processes. The framework is summarised in the form of a *Communicative Model of Collaborative Learning* presented in Table I.

CMCL identifies and classifies language acts as constituents of collaborative learning along two dimensions: the dominant orientation of learners and the domain of knowledge. First, the model identifies orientation to learning (manifested as a wish to know, to interact with others to increase mutual understanding and construct knowledge cooperatively); then orientation to achieving ends (manifested by students' primary motivation to succeed eg. to get a pass or a good mark or to get the best mark in the class); and orientation to self-representation and promotion (manifested by students' attempts to make an impression on others, portraying a particular image of self). Second, the model differentiates between language acts that refer to different domains of knowledge, such as those related to subject matter and any substantive issues (theory, application, problem solving, etc.); linguistic acts addressing norms and rules that regulate the conduct of interactions and interpersonal relations in the collaborative learning process; and linguistic acts addressing personal experiences, desires and feelings by which students express themselves and shape both their individual and collective sense of self and of their learning process.

CMCL thus enables classification of linguistic acts produced in particular learning situations according to the 3×3 scheme (Table I). Communicative analysis based on this model is concerned with what a specific linguistic act refers to and at the same time how it contributes, what it enables (in the flow of linguistic acts in a conversation) in the construction and maintenance of collaborative learning processes. Although, for instance, a certain linguistic act may be of the same type eg.

disputing (assumed or accepted) norms and rules, what it actually produces depends on the student's orientation. A student oriented to learning may dispute a norm seeking mutual understanding with other students and cooperative resolution of the dispute; on the other hand, a student oriented to achieving a good mark may dispute a norm if it does not suit his/her particular goals, seeking to change it without being much concerned about others; a student oriented to self-presentation may dispute a norm for the sake of presenting himself/herself in a particular way, eg. as an important, influential and respected group member. It is important to note that interpretation of a linguistic act is always within a context of the learning situation and the flow of linguistic acts constituting the learning process.

In the following sections, we present findings from using CMCL to analyse the transcripts of the student bulletin board discussions throughout a semester. The discussion is focused on students' communicative practices, the generation of collaborative learning conditions and the productivity of the collaborative learning spaces.

The Research Setting

This study is located at a 'new' Australian University, created by the amalgamation of former colleges of advanced education. The empirical research is situated within an innovative, multi-mode delivery of a third-year undergraduate management subject (Semester 1, 2000). Systematic restructuring of the subject aims to improve student learning in three ways: first, deeper learning of management concepts and theories through collaborative teaching and learning strategies; second, better understanding of the value and use of management theory in practice by employing it in collaborative learning projects; third, better development of the generic skills (Falk, 1999) required to work successfully in groups, self-managing teams and organisations by integrating this deeper learning in group projects. These learning aims and their corresponding teaching and learning activities are constructively aligned with the assessment criteria throughout the subject (Biggs, 1999). Furthermore, the design of assessment tasks and their criteria seeks to "find ways of embedding formative thinking into all acts of learning" (Boud, 1999). The project is thereby situated within current educational trends towards innovative forms of teaching for, and learning of, those qualities and skills increasingly required in rapidly changing workplaces. Thus collaborative learning in workshops and web-mediated environments are carefully structured to parallel the various components, complexity and challenges of working in organisations.

The class in this study formed an organisation (Tyson, 1999) within which groups of students undertook team projects contributing to organisational objectives. The processes of social interaction shaped by this strategy facilitated collaborative learning. The curriculum (domain of knowledge) focused on organisational behaviour and management, as well as the development of groups towards self-managing

		Knowledge domains	
Dominant orientation to	Subject matter (1)	Norms and rules (2)	Personal experiences, desires and feelings (3)
Learning (A)	A1—Linguistic acts about subject matter raised in order to share views and beliefs, to provide arguments and counter-arguments leading to mutual understanding and knowledge creation	A2—Linguistic acts that establish norms and rules regarding interaction and collaboration; co-operative assessment of legitimacy, social acceptability and rightness of individual behaviour	A3—Linguistic acts expressing personal views and feelings about learning process and other learners aimed at sharing experiences and increasing mutual understanding
Achieving ends (B)	B1—Linguistic acts that raise or dispute claims and provide arguments about subject matter, with an intent to frame attention, influence others and achieve goals	B2—Acts of changing or interpreting norms and rules about the interaction process so as to suit a particular student interest and goals (may be at the expense of others)	B3—Acts expressing personal experiences in a way that influences other learners and instructors so as to help achieve goals (e.g. emphasising personal success)
Self-representation and promotion (C)	C1—Raising or disputing claims and arguments as a performance on a stage that serves personal promotion (often neglecting an ongoing argumentation process)	C2—Raising or disputing claims about norms/rules or their violation in order to attract attention and establish oneself as a distinguished student (e.g. a leader, an authority)	C3—Linguistic acts expressing personal experiences and feelings that project an impression of importance in a group or of a key role in a situation (e.g. self-promotion or domination)

TABLE I. Communicative Model of Collaborative Learning (CMCL)

teams. The curriculum supported collaborative learning processes through team projects. The team project required students first to complete exercises to support their development and understanding of team skills (Gibbs, 1994). Students were then required not only to design topic-related creative learning activities for class participation, but also to identify two series of assessment criteria for their team learning achievements: assessment by their own team and assessment by other teams (10% of final assessment). The successful completion of these tasks, with the support of the facilitator, produced a framework within which discursive practices of collaborative learning were generated, established and later evaluated (5%) by students.

To extend and enhance the opportunities available during two hour face-to-face weekly workshops, a web interactive study environment (WISE) that provided institutional support for staff adopting online teaching and learning strategies, was introduced (Sheely *et al.*, 2001). In its online environment, eight electronic bulletin board forums were established for groups and organisational divisions, as well as a main forum where messages across the whole organisation could be posted. The main forum was also used, after an introductory training session, to support the development of web-related skills, and for posting contributions on different topics from preparatory web-mediated activities, such as on-line quizzes (10%), internet exercises (15%) and textbook readings.

Whilst web technologies provided a medium for engaging students more fully in reading and quizzes, the requirement to develop collaborative learning was embedded in most assessment tasks. Contributions to the bulletin board formed an integral part of subject assessment (15%) with their orientation to collaborative learning being one of several assessment criteria. Students were required to select their best five contributions throughout the semester and annotate these according to such criteria. Furthermore, communication in on-line team forums and divisional forums required collaborative learning processes were made in a reflective journal (25%) comprising weekly entries describing what happened, analysing group processes, and suggesting improvements for team task performance and group maintenance. The design of the subject is thereby illustrative of integrating the use of web-based technologies into collaborative student learning (Housego & Freeman, 2000).

The majority of the students enrolled in the subject were female (72%) and undertaking a compulsory unit in a Bachelor of Applied Science (Food Technology). On the other hand, those students electing to take the management subject came from diverse degrees and were mostly male. Almost all were employed at least part-time in workplaces related to their field of study. Neither students nor facilitator had engaged in previous web-enhanced learning. In the 13 week semester, the 34 students produced over 1000 postings on the bulletin board set up to enable collaborative learning. Of these messages, 85% were linked by topic in 66 threads with between 4–28 messages in each thread, one indicator of the significant extent of collaborative engagement amongst the cohort. Using NVivo, a software program

Dominant orientation to	CMCL code	Total coded messages	% of total messages	Female % of total	Male % of total
Learning	A1	258	44	45	40
(A)	A2	87	15	17	8
	A3	104	18	18	16
	Total A	449	76	79	64
Achieving ends	B1	22	4	3	7
(B)	B2	12	2	2	3
	B3	77	13	13	13
	Total B	111	19	18	23
Self-representation	C1	10	2	1	4
and promotion	C2	4	1	0	3
(C)	C3	16	3	2	6
	Total C	30	5	3	13
Totals		590	100	100	100

TABLE II. Student communicative patterns

developed for rich, unstructured data, and Excel, 738 postings to the main bulletin board were examined and sorted, and 590 were then coded using the conceptual framework which we now discuss below.

Methodology

Codes from the 3×3 CMCL matrix (Table I) were assigned to the 590 postings in the 66 threads where social interaction was sustained on a topic by more than 3 students. For the purposes of this study, each message was treated as one linguistic act. Each communication was interpreted within the context of its thread for the dominant orientation of the learner and its domain of knowledge.

A two part interpretive process was followed. Messages were read first for the dominant orientation for the learner and a code (A, B or C) assigned. Messages were then read for the domain of knowledge, with the main subject being allocated a code (1, 2 or 3). This procedure gave each message a coding which was checked against the specific criteria in the relevant box of Table I. Using the context of the thread, the dominant orientation of the learner was more readily identified and of most relevance to this investigation. Assigning of codes (1, 2 or 3) to the domain of knowledge was more ambiguous but less critical to this study. Since the management curriculum required discussion of both subject matter (1) and norms and rules (2) within organisations, and the assessment design encouraged reflection on personal experiences (3) in the workplace, some overlap across these code boundaries was not surprising.

Student data on course, work experience, age and gender was collected and entered into NVivo enabling students' communicative practices and changes in



FIG. 1. Development of collaborative learning space.

social interaction processes throughout the semester to be examined. A discussion of these two aspects follows.

Students' Communicative Practices

The ways in which students employed linguistic acts are presented in a different format in Table II for the purposes of briefly summarising the overall analysis. Of the 590 contributions to the bulletin board that were coded, 76% were directed towards learning about the subject matter, with fewer directed to achieving ends (19%) and even less (5%) with self-representation and promotion. There are notable gender differences in linguistic acts (Yates, 1997), a feature that is consistent with the considerable body of research literature on gendered communication (see for example, Poynton, 1993). Contributions to learning were posted more often by female students (79% of their messages) than by males (64% of their messages) whereas males were somewhat more concerned with achieving ends (23%) compared with their female peers (18%) and with selfrepresentation and promotion (13% of males' messages compared with 3% of females' postings).

Development of Collaborative Learning Conditions

The generation of a collaborative learning space over the semester is mapped in Figure 1. The number of postings indicates the intensity of interaction and the colour white, grey or black denotes student orientation to learning, achieving ends or self-representation, respectively. Initially (weeks 2–3), while students became familiar with a new technology and a new form of active, student-centred learning, their focus was as much on achieving ends as it was on learning. Detailed analysis of postings show that students began to focus on learning by co-operatively assisting each other in their adoption of the unfamiliar web technologies. At this early stage, they were equally concerned with the ways their collaboration would be organised and regulated as they were with how their contributions would be assessed.

However, by week 4, their focus was well established on learning, not only with significant increases in the number of postings but also a rapid increase in linguistic acts that established a collaborative discourse on the main bulletin board. In weeks 7–10, most activity took place not in the main forum but in private team forums directed towards their team project presented in weeks 9–10. Two hundred and seventy-three postings from these private forums were not included in the graph in Figure 1, and are not analysed in this study. In weeks 11–12, the effect of approaching assessment and submission dates partly accounts for the rapidly increased numbers of postings on the main bulletin board.

The nature and intensity of postings on the bulletin board throughout the semester provide an indication how collaborative learning conditions were generated and maintained. The facilitator set up the context of the bulletin board as a forum for students to assist each other with their learning and explicitly positioned herself in a monitoring role. Although supportive in their orientation and online socialisation (Salmon, 2000), the facilitator tended to progressively withdraw from initiating threads and responding to queries, leaving students space to contribute to each other as they developed understanding and skills. For example, a discourse of collaborative learning was initially generated on the bulletin board, which was a new medium for most of the students, by the facilitator setting up a 'collaborative HELP' thread where students could help each other in getting started and share their newly-developing skills and knowledge of web-mediated learning.

After this initial phase (weeks 2–3), the interaction entered a high intensity phase in weeks 4–10 (with an average 80 postings per week including team forums) during which collaborative learning conditions were fully established. Here the role of the facilitator was to set up private team forums and to monitor the main organisational forum. The subject's design as an organisation itself supported collaborative learning to achieve organisational outcomes. As such, both information exchange between teams and knowledge construction (Salmon's third and fourth phases of online learning) took place during this period. An example is analysed in the next section of this paper.

In the last phase, weeks 11–12, the intensity decreased slightly reflecting the completion of the team projects and the assessment tasks. Such a 'pattern' of the development of the collaborative learning space matches students' needs for collaborative learning throughout the subject and can thus be considered satisfactory. However, a different subject design and assessment criteria would have produced a different pattern of participation across the semester. For example, continuity of contributions as an assessment criteria itself, adopted in a subsequent design of the subject, lengthened the period of collaboration and militated against fewer last minute postings by less engaged learners.

Productivity of Collaborative Learning Space

One set of data from the main forum has been selected (Table III) to demonstrate how students constructed knowledge together about organisational communication.

I ADLA III. I VILLVIU IAVVIL LIIVAU	
Subject: ATTENTION ALL ORGANISATION MEMBERS CONCERNING THE PORTFOLIO LAYOUT	CMCL codes and interpretive comments
Article No. 639: posted by Esther on Saturday, April 8, 2000, 04:23 Hi everyone, the following attachment involves our team's proposal for the layouts of the management portfolio. Please open the attachment and take a look at it. We importantly need your feedback by Thursday the 13th of April, 2000. Thank you very much! =) From The Prototype Team.	A1 Informs and invites collaboration for mutual understanding on attached proposal
Article No. 658: posted by Amy on Sunday, April 9, 2000, 18:11 Ok here is what I think. For one thing, I am unable to view the "proposed layout" as it is not in a format compatible with any of the software on my computer. Secondly I am curious to know whether all of those people (including me) who have already organised their portfolio and journal in a certain way, if they are meant to go back and totally reformat what they have done up to now. If that is the case then I think that it is totally unrealistic and I myself will not be doing that	B1, B3 Concerned with how things are to be done for personal success, expresses her own frustration, seeking clarification as well as conditional refusal
Article No. 668: posted by Esther on Sunday, April 9, 2000, 21:50 For one thing, if you don't like what we are doing here, address your hostile complaints to the CEO (Lecturer), or to the IR [Industrial Relations] group. As requested by the CEO, the layout/presentation of the Portfolio has to be similar for everyone as she has been finding it difficult to comprehend the layout of everyone's portfolios So the purpose of the attachment was that to see if everyone agrees with the layout that our group have already come up with, or if not then any suggestions/ideas on how it should be presented In any organisation, I'm sure that you'll find that specific documents are presented in a compulsory setup so that they can be easily accessed, and understood. That is all!	A1, A2 Employs organisational language and concepts from the subject, explains relevance of task and the assumed role of the CEO; emphasises mutual understanding whilst refusing the hostility
Article No. 672: posted by Michael on Monday, April 10, 2000, 12:33 I think there are a few things we need to do to avoid this problem becoming another source of anguish to all of us I also appreciate that the team who posted the suggested layout are acting on instructions/direction/suggestions from the CEO and are only trying to achieve their aims and objectives in relation to the workshop exercises so that they will be assessed in a favourable way for the task they have undertaken. It may simply be there has been another break down in the already confused communications system of the group. To clarify this situation there are some questions we need to ask Due to the CEO being unavailable for comment, it will be necessary for ALL members of the group to discust this situation and resolve it. Our resolution can then be given to the CEO on her return as being the will of the group. If it eventuates that there develops a read afformat for the presentation of the portfolios then the members of the group may have to accept it and comply with that format. Michael	C2 Positions himself as a member of the Industrial Relations team and in opposition to 'management' as represented by the CEO and her 'directives'. Seeks to promote self as spokesperson of wider dissatisfaction assumed to be shared by others

TABLE III. Portfolio layout thread

i Michael, i Michael, Ya mawers to your questions are below each question, just scroll down Has the CEO indicated that only the instructed /directed/suggested format is to be accepted and will any diversion be penalised? cell here is the flexible part of the whole thing. Last week as our team showed to the CEO what we have come up with for the yout of the portfolio, the CEO had specifically suggested to our team to conduct the survey in question. This is so that eryone in the organisation can give their own suggestions/views on how to present the portfolio, so that in the end our team can me up with the best possible solution The layout that our team have posted on the BB is just a suggestion therefore in the reyone. Well that is all for now. I hope that our team's answers all make some sense. hands for the heb. =) The Protover Team =)	A1, A2 Responds to previous participant, assuming to inform and continue collaboration rather than taking up his leadership of dissent. Thereby establishes the proper process and conditions for ongoing collaborative learning about how to get the team's task accomplished in spite of potential barriers
cle No. 766: posted by Jess on Wednesday, April 12, 2000, 15:33 <i>y</i> is everyone getting hostile at Esther? she is only trying to do her job (as is everyone else!). I think that the proposals that <i>b</i> been suggested are helping to clarify what is expected in the management portfolio, although many of us have been trying eep up to date with the self-rests etc, many of us did not know how to present them, so thanks a lot Esther (and team) nelping us all out. JESS.	A2, A3 Appreciates and clarifies the organisational role of a colleague and her team and expresses gratitude
cle No. 676: posted by Larissa on Monday, April 10, 2000, 14:32 st want to comment about the fact that we are all part of one organisation. I think the purpose of this is that so that we can all k together, help each other out with whatever job is given to us. But instead, it feels like each divisions are competing with 1 other?? How can we manage to build a strong organisation when everyone is working against each other? I think that we all id support each other. I hope I got my message across for those people who cares.	A3 Reflects on experience of student competition and demonstrates deep learning of the need for co-operation in an organisation to achieve its objectives
cle No. 744: posted by Jane on Monday, April 10, 2000, 17:40 nts Latissa for that. I know what you mean. I think people are still in the mode of other subjects which is really hard habit ick when you are used to that sort of atmosphere.	A3 Establishes mutual understanding regarding learning experience and generalises knowledge about collaboration from this and other subjects

This Portfolio Layout thread, comprising 32 messages during weeks 7–8, is 'scaffolded' for the purposes of briefly illustrating how the CMCL framework is applied to analyse the flow of messages leading to knowledge creation and what supported and obstructed this flow. Such analysis thus enables an inside view of the productivity of the web-mediated environment. In the table below, the student's posting is placed in the left column and the CMCL coding and interpretive comment in the right column.

By applying the CMCL, it is possible to see that some students (Esther, Jess, Larissa and Jane) are orientated principally to learning (A). Amy and Michael are more orientated to achieving ends (B) and self-representation (C) respectively. The focus of student contributions vary from concern with the subject matter (Esther as team leader undertaking a task), to the application of norms and rules (Jess's focus on Esther's organisational role, Michael's focus on attracting the attention of ALL the organisational members to express their 'will' to the CEO), to personal experiences, desires and feelings (Amy's frustration with how to present her Portfolio successfully without additional work, Larissa's and Jane's reflections on the Portfolio communication thread to make meaning from their experiences of the process).

The exchange of messages demonstrates how some communications create knowledge (Esther's request for feedback and her responses to Amy's and Michael's challenges) whilst others are less concerned with collaboration about learning and more concerned with taking up leadership of a different agenda (Michael's dissatisfaction with the subject and its evolving conditions). Most importantly, the collaboration draws out explanations of how most organisations use standard document layouts (Esther), how roles are to be differentiated from the person doing a job (Jess) and how an organisation relies on cooperation between divisions to meet its objectives (Larissa). This management subject matter, essential to student learning is co-created throughout the discussion as students variously raise claims, respond to questions and requests for clarification, seek to influence and challenge knowledge, and seek to resolve, in this case, the specific issue of their Portfolio layout.

Methodological and Pedagogical Implications

This study enables us first, to begin to make sense of student messages and the processes of knowledge co-creation in web-mediated collaborative learning; second, to raise pedagogical implications in the deployment of web-mediated technologies for collaborative learning; third, to assess the value of the CMCL model itself as an investigative tool; and fourth, to identify emerging research questions in this newly expanding web-enhanced teaching and learning domain.

By analysing first linguistic acts in individual messages and then the flows of linguistic acts in the forum (based on CMCL) we are able to interpret the meaning of student postings and understand the way students interacted and learnt collaboratively. Furthermore, we are able to understand how students use linguistic acts to express their beliefs and experiences, to govern the interaction process and achieve cooperative meaning-making, knowledge sharing and co-creation.

Such an analysis suggests a number of pedagogical implications. One is the question of how the 'ideal learning conditions' (Cecez-Kecmanovic & Webb, 2000a) are generated, shaped and maintained. Identification of the different types of orientations of learners enables a staff facilitator to monitor students' linguistic acts so as to encourage or intervene in interactions as appropriate. By providing exemplars of collaborative linguistic acts and coaching in responding to early postings, A level contributions in all 3 domains (what students learn; how they relate to each other and regulate their interaction processes; and how they feel about their experiences) may be encouraged to hasten the development process towards ideal learning conditions. In this study, 57 messages on the main bulletin board from the staff facilitator were identified as undertaking this contribution to shaping and maintaining collaborative discourse. It is also possible, though in this cohort not considered necessary, for the staff facilitator to identify and intervene where dysfunctional B and C attitudes (such as achieving one's goal by disregarding others' interests or at the expense of others, or promoting oneself by instrumentalising others) may frustrate or inhibit the collaborative learning of other students. Such interventions recursively shape and maintain collaborative learning conditions.

This study suggests that CMCL provides a useful tool for investigating collaborative learning processes enabled by web-enhanced activities. By applying this model to bulletin board exchanges, it was possible to examine these collaborative learning processes from within the spaces where linguistic acts were conducted by and between students themselves, a view from *within*. It was also possible, from coding the range and complexity of the students' linguistic acts into the CMCL as initially conceptualised, to identify where some further developments to the model can be made.

Future research methodologies may include developing methods using CMCL with NVivo to investigate the flow of knowledge creation in web-mediated learning environments. Such a method would enable comparison to be made of the relative applicability of different learning strategies and web-mediated technologies.

The communicative analysis of student electronic postings based on CMCL, as this paper provides, demonstrates how we cannot assume that by providing technologically-advanced environments such as web-enhanced discussion spaces, successful collaborative learning will necessarily take place. It highlights the need for careful shaping of collaborative learning conditions, attentive to the communicative needs of learners, and sensitive to subtle forms of knowledge co-creation. There are clearly further challenging pedagogical issues for designers of these new environments as the comment of a divisional student leader, asked to evaluate the active learning of his team members implies, students "... don't yet realise just how much they are learning this way".

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