

LONELY OUTPOURINGS OR REASONED DIALOGUE? AN ANALYSIS OF TEXT-BASED CONFERENCING AS A TOOL TO SUPPORT LEARNING

¹McLoughlin, C. and ²Luca, J.

¹Teaching and Learning Centre
University of New England

Email: mcloughlin@metz.une.edu.au

²School Of Communications and Multimedia
Edith Cowan University

Email: j.luca@cowan.edu.au

Abstract

While computer-based tools to support asynchronous dialogue and discussion are now part of many on-line units of study, there is a lack of research on how to assess the quality of such interactions, and in particular, how they support learning. Mason (1991: 161) posed the question: 'Are conference interchanges more than merely the outpourings of lonely or loquacious students?'. Since then several theorists have provided interaction analysis/content analysis techniques to examine the construction of knowledge in computer conferencing. These are reviewed in the light of constructivist theories of knowledge and the adoption of a socio-cultural model of learning, emphasising social interaction and dialogue as central to learning. If knowledge construction is to be evaluated rather than knowledge reproduction, we need to assess the processes that support such construction, and consider negotiation and revision of knowledge. For tertiary students, working with others in teams, evaluating others' perspectives and the ability to communicate abstract ideas are recognised and valued educational outcomes (Tinkler, Lepani & Mitchell, 1996). A valid framework for analysis would therefore require a focus on process variables, such as how learners negotiate and interact, and product variables, such as the content and outcomes of learner interactions.

These questions are investigated in the context of a tertiary on-line unit designed to teach project management skills for multimedia development. An on-line forum was created for students to discuss and compare their interpretations of concepts and to establish shared understandings. The analysis focuses on whether the interchanges that occurred reflected knowledge construction, deep understanding and in depth inquiry, rather than superficial comments. In addition, student perceptions of the on-line forum were investigated. The study provides a practical assessment tool for educators to evaluate on-line discussion and shows the potential of an on-line forum to support collaborative learning and construction of knowledge.

Keywords

Computer conferencing, on-line learning, constructivism, content analysis, social interaction, student perceptions, evaluation

Introduction

On-line forums provide opportunity and potential for collaborative work, dialogue and study that can increase the flexibility of learning while motivating participants. By enabling teacher-learner and learner-learner dialogue computer-based course systems can support the essential elements of a learning conversation by providing scope for discussion, interaction, dialogue and reflection (Laurillard, 1995). Harasim, Hiltz et al (1995) have argued that this medium presents a whole new educational domain, unique in its potential for interaction, participation and collaboration and a departure from face-to-face didactic paradigms of learning. Yet the types of verbal interactions and the means by which new knowledge is created on-line are not well understood. It is imperative for tertiary teachers and moderators of computer conferences to ensure that the processes and activities that occur in text-based conferencing are conducive to learning while supporting collaboration.

Learning on-line: Social competencies and lifelong learning

In devising assessment criteria for on-line forums many aspects of student learning may be overlooked as these may be the unintentional skills developed during the process of learning on-line. For example, students learn the social skills of interacting on-line and communicating with others. These communication and negotiation protocols are socially constructed and come into play as the group faces new on-line challenges such as interpretation of ideas and problem solving. Such skills are part of the emphasis on self-directed learning, as Candy (1991; 246) wrote:

In the past learning was seen essentially as a personal quality or attribute, ... a fixed and enduring set of facts to be mastered... In the new view self-direction is acknowledged as a product of the interaction between the person and the environment.

Here, Candy affirms that learning is essentially social and interactive, located in the context and socio-cognitive processes of interaction. When assessing the contributions that learners make to computer conferences, the most salient aspects for analysis are those processes that relate to self-directed inquiry, constructivist learning, reflection, interactivity and collaboration. Harasim (1989: 60) referred to computer conferencing as ‘an augmented environment for collaborative learning and teaching giving learners flexibility, choice and freedom and enabling divergent thinking through idea generation’.

Most research on computer conferencing has been positive about its potential and outcomes, promoting its advantages and merits (Eastmond, 1994, 1995; Harasim, 1994; Henri, 1990). However, it may be best to adopt a more skeptical and critical view and to question whether the advantages of computer conferencing may be exaggerated. According to Mason (1990: 23) educators may have unrealistic expectations: “The motor car was only expected to be as good as the horse. Computer conferencing is expected to provide the social and information requirements of an entire university without ever leaving the confines of one’s own island.”

From the perspective of assessing its contribution to learning, it is therefore important to establish whether knowledge construction is achieved within a computer

conference, and how text-based interaction achieves learning outcomes. By conducting an analysis of the dynamics of an on-line forum discussion, it is possible to understand the nature of inquiry, the quality of dialogue and outcomes of student-student interactions and to build on these aspects in order to improve the design of the conferencing activity.

Context of the study

The final year students in the Interactive Multimedia course at Edith Cowan University are required to develop skills and expertise in project management. A unit of study on project management is delivered on-line using WebCT software, and is available on-campus and in the distance mode of study. Students learn about project management methods (such as needs analysis, design specifications, storyboards, concept maps, evaluation, legal issues, quality auditing, scheduling and costing) and put them to practice by creating a web site in project teams. The objective of the team project is to promote team and client collaboration skills by focussing on a common task.

Students are continuously assessed throughout the duration of the one semester unit. The assessment consists of project team-based work, task-team work, peer assessment, individual reflective reports, a client mark and individual postings to a weekly forum. Participation in the conferencing task is continuously assessed throughout the semester. The task team assessment requires the team to publish a short summary paper on the bulletin boards at the beginning of the week on an aspect of project management such as team dynamics, legal issues, scheduling etc. and to raise issues for discussion. The task team is also responsible for moderating the discussion during the week and then providing a synopsis at the end of the week. Usually students assume roles within the forum so that each team member participates in a task such as:

- production of a short outline/issues paper
- discussion moderation
- questioning
- synopsis and summary.

Students are assessed on bulletin board contributions, which account for 30% of their total mark. Participation in the forum is compulsory. There is little intervention by tutors in the discussion forum except to provide explanations and procedural information when required. Students are left to develop a discussion which is relevant to the assigned topic and the forum is therefore truly student centered. The structure of the weekly contributions and roles of team members do not vary, and each week there is a forum leader, a questioner and a summariser of information.

Table 1 provides a summary of the week-by week topics and the number of messages posted each week.

Research questions

The focus of the research was to evaluate the educational potential of the forum by investigating the quality of interactions that occurred. Specifically, the aim was to investigate:

- the nature of the text-based interactions and whether the contributions were educationally valid and led to knowledge-building processes or merely social interchanges;
- whether students regarded the discussion forum as a serious learning tool.

Table 1: Total number of messages posted to the forum on a week-by week basis

Forum	Total Messages
All	1096
Course Satisfaction	19
Main	341
Virtual Coffee Shop	0
Week 1- WebCT Questions	64
Week 2- What is project management?	78
Week 3- Team Issues	56
Week 4- Needs Analysis	94
Week 5- Planning, Costing & Scheduling	97
Week 6- Design Specifications	46
Week 7- Legal Issues	65
Week 8- Production, Evaluation & Testing	101
Week 9- Quality Assurance	49
Week 10 Handover & Closing	84

The primary objective of the research was therefore to analyse the value of the discussion forum for knowledge construction, to refine the assessment instrument used by tutors, and to assess the activities planned for the forum. A further goal was to go beyond the superficial counting of utterances and quantitative analysis of messages to a deeper understanding of communication and learning processes on-line. The need for research in this area is becoming more urgent as off-campus modes of delivery utilise computer conferencing and several Web-based course support systems provide functionalities that enable discussion between learners. Up to now the adoption of computer conferencing has flourished despite the paucity of research and theory on which to base its contribution to knowledge development in learners.

Literature review linking on-line discussion to learning

The on-line forum developed for Project Management is an asynchronous learning environment in which group collaboration takes place through the mediation of technology. The participants in the on-line forum in the first semester 1999 could be regarded as a community of adult learners. Some learners had extensive practical

experience in project management for interactive multimedia. Others were relative novices. The aim of the forum was to provide a learning environment where participants could share knowledge, discuss ideas and contribute to each others' understandings of important issues in the management of multimedia development.

In reviewing literature relevant to this unique community of on-line learners, a socio-constructivist perspective seemed most appropriate. The socio-cultural approach to learning requires close examination of the contexts in which the learning occurs, and is illustrated in the work of a number of practitioners and researchers (Mercer, 1993; 1994; Forman, Minick and Stone, 1993; Laurillard 1995). A social-constructivist approach to learning is also reflected in the words of Säljö (1994: 91) who states that '... it is important to consider seriously the role of communication and interaction for learning, and to employ analytical perspectives in which the natural habitat for individual action is shared human activity'. An analytic approach consistent with this focus on communication and interaction can be found in socio-cultural theory. As the originator of socio-cultural theory, Vygotsky (1978) was most concerned with higher mental functions which he regarded as indicative of the superior mental life of human beings. His work had been reinterpreted by socio-cultural theorists who emphasise cognition as a social achievement, or a form of enculturation fostered by teachers (Moll & Whitmore, 1993; John-Steiner, Panofsky & Smith, 1994; John-Steiner & Mahn, 1996). In social settings where language is used to communicate ideas, the learner engages in particular socio-cognitive language-based operations, such as generalising, hypothesising, and inferring. Thinking and learning therefore arise in functional and social settings where language is used communicatively. According to Wertsch (1985) higher mental functions, such as learning and abstraction are characterised by the individual's increasing control over these processes, and conscious awareness of how to apply them.

In summary, social constructivist theories based on the work of Vygotsky (1978; 1986) have become accepted in all fields of education, including the application of technology to teaching and learning (Jones & Mercer, 1993; Duffy & Cunningham, 1996; McLoughlin & Oliver, 1998). The emphasis on learning as socially grounded is particularly relevant to computer conferencing transactions where 'learning has a social quality by virtue of its relation to practices of interpersonal exchange, participating in relevant discourse and joint activity' (Crook, 1994:74). The use of computer conferencing can support interpersonal exchange, and on-line text-based interaction has the capacity to engage learners in the social construction of knowledge (Hiltz, 1994).

Approaches to the analysis of on-line talk

Recently, there have been several attempts made to provide an analysis of 'cybertalk', though examination of the transcripts of text-based discussions (Eastmond, 1995; Mason, 1991). At the same time there is well-documented evidence of strongly opposing views as to how talk should be treated as evidence of learning and of thought (Edwards & Westgate, 1994). Among the approaches to talk-analysis which have contributed to our understanding of group interaction there are several: sociolinguistic, ethnographic, conversation analysis, systematic observation, and interaction analysis, each with a distinctive array of analytic procedures and conventions for setting out transcripts of data, drawing inferences and analysing cognitive processes.

Originating with Flanders (1970), interaction analysis describes and categorises various forms of instructional practice that take place between teachers and students where there is a teaching-learning speech transaction. Categories used to code behaviours tend to be prescriptive and narrowly defined, reflecting static rather than dynamic patterns of interaction.

Other studies have used variations of the coding process. A recent study of peer interaction during collaborative writing with computers (Kumpulainen, 1996) used a system of analysis which classified linguistic utterances according to the functions displayed. In a study of the development of scientific reasoning, Azmitia & Montgomery (1993) used a coding scheme to quantify features of scientific reasoning which included justifying solutions, evaluating, clarifying, questioning and explaining. This research, like that of Nastasi & Clements (1992) was based on the Piagetian concept of cognitive conflict, which related success in problem solving to the degree of conflict or verbal disagreement that arises among peers. The data analysis procedures were nevertheless of interest to the present study as they highlighted the role that dialogue and transaction played in supporting reasoning and testing of ideas which are outcomes expected of tertiary students.

A related approach to data analysis is content analysis (Henri, 1992), which highlights critical dimensions of the learning process and conducts an analysis on a multilevel basis, assigning behaviours to different features of the learning process. Henri developed a content analysis model based on four dimensions, relating to the educational quality of messages. Four dimensions were proposed for transactions:

- social
- interactive
- metacognitive
- cognitive.

A further dimension relating to the qualitative aspect was a quantitative dimension, the cumulative effect which reflected the total number of messages posted by one person, as an indicator of the level of participation. The limitation of Henri's method of analysis is that it was designed for contexts where there was a strong teacher presence, and is not readily applicable to a learner-centered conferencing environment.

Adoption of a five phase model of content analysis

Henri's (1992) model of content analysis has been elaborated and transformed by Gundwardena, Lowe and Anderson, (1997) who propose a social constructivist approach to knowledge building in on-line environments. Their five phase analytic model proposes that knowledge construction moves through five levels from knowledge sharing to knowledge building.

PHASE 1: SHARING AND COMPARING OF INFORMATION

In this phase, verbal transactions take the form of statements and observations.

PHASE 2: DISCOVERY AND EXPLORATION

During this phase participants become aware of differences in views and interpretations. Typical utterances at this stage would be questions, clarifications and elaboration of concepts.

PHASE 3: NEGOTIATION OF MEANING AND CO-CONSTRUCTION OF KNOWLEDGE

In this phase there is evidence of negotiation of outcomes and areas of agreement and disagreement, with proposals for mutual understanding.

PHASE 4: TESTING AND REVISION OF IDEAS

Interactions would include statements of evidence against criteria, use of examples and investigation of alternative viewpoints

PHASE 5: AWARENESS OF NEWLY CONSTRUCTED KNOWLEDGE

This phase would entail metacognitive statements demonstrating new knowledge construction and reflection on areas of agreement or disagreement.

The analytical tool developed by Gundawardena, Lowe & Anderson's (1994) was adopted for content analysis of the on-line transcripts as it provides an appropriate tool that was consistent with the goals of the study, ie to investigate knowledge construction processes on-line. This model of content analysis reflects the collaborative and social processes of learning in on-line forums. Other methods of content analysis (Henri, 1992; Flanders, 1970; Azmitia & Montgomery, 1993) were found to be unsuitable as they were developed for environments which were largely teacher-centered. The on-line forum was designed as a constructivist student centered environment where collaboration, sharing of ideas and group discussion were paramount.

Methodology

The study used a combination of research instruments and approaches. First, the weekly text-based discussion forums were compiled to provide a corpus of data. The researchers conducted a transcript analysis using the five-phase content analysis approach to investigate the nature of student talk. In addition, a student questionnaire in the form of a survey instrument was designed to elicit students' views on how the forum contributed to learning (Table 2). The use of these two analytic approaches enabled triangulation of data sources and provided multifaceted analytic tools with which to analyse the dynamics and processes of on-line discussion. The survey instrument and the analysis of transcripts involved a range of procedures.

Table 2: Survey instrument dimensions *

Knowledge building questions	Group work questions
• Topics discussed were relevant	• The forum assists group work skills
• Opportunity to deal with original topics	• There is commitment to group discussion
• Development of novel views and ideas	• There is a need for the forum
• Opportunity to consider many perspectives	• There is scope for in depth discussion
• Fostered reflection	• The forum supports sharing of ideas
• Opportunity for integration of new knowledge	• The forum gives opportunities for team work
• Development of understanding	• The group acknowledges contributions

*These columns summarise the questions asked of forum participants

The student survey

The survey instrument consisted of two parts each with a number of Likert scale questions. Part one focussed on the knowledge building aspects of the forum and asked students to rate the value of the forum in terms of its relevance, opportunities for collaboration, reflection, discussion, exposure to new ideas and understanding. Part two of the survey instrument asked students whether the forum supported group work, collaboration, feedback and collective goals (Table 2).

Transcript analysis

The analysis of the forum transcripts consisted of a number of procedures. In the first stage of analysis, the overall pattern of talk was reconstructed by means of a concept map showing the flow of interactions, and the number of postings that each thread attracted from students. This visual approach enabled the researchers to make sense of the data. For example, Figure 1 shows the global pattern of talk for week 4.

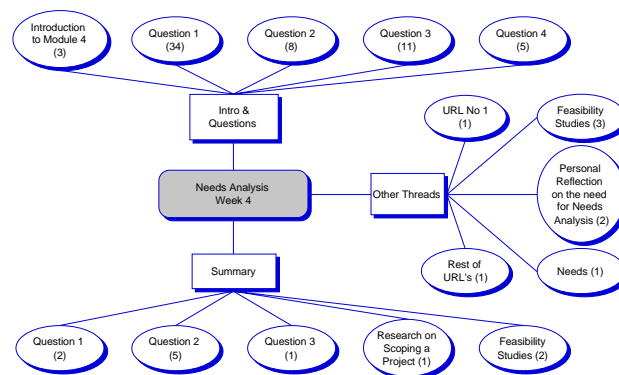


Figure 1: Visual map of the messages posting for week 4

The topic in Figure 1 is *Needs Analysis*, and the team assigned to this task generated questions relating to the topic. Each of these questions forms a discussion thread, and students posted comments, questions and examples on each question. Students also had the opportunity to start new threads on subtopics and Figure 1 shows that five additional threads were created, some attracting multiple contributions. These topics covered feasibility studies, reflection, and comments on URL's and new URL's. By mapping the pattern of interactions in this manner, it was possible to achieve an overview of the data.

The second stage of analysis involved assigning each message to one of the phases of the model by two researchers. Discrepancies were discussed and an agreement on coding was concluded from these discussions.

Results

Because of the amount and complexity of data in each of the weekly discussions, it was decided to investigate only a portion of the whole corpus and to analyse three consecutive weeks of the forum discussions. Weeks 3, 4 and 5 were selected for content analysis, and the researchers assigned each message to one of the five phases

of knowledge construction. Table 3 shows the total number of messages posted for each of these weeks and the number of messages in each phase. While the visual map of the data for week 4 shows a large number of balloons marked 'questions' (Figure 1), these were not questions in the sense of learners questioning each other: rather, they were starting points for discussion posed by student teams relating to the content. The numbers in each of these balloons refers to statements and comments made in relation to the 'questions'.

Table 3: Summary of content of the messages in weeks 4, 5 and 6

Categories for data analysis	week 4 *n=94	week 5 n=97	week 6 n=56
Phase 1: Sharing & Comparing • statements of observation, examples and descriptions	63	63	37
Phase 2: Discovery and exploration of difference • Questions, clarifying statements, identifying different views	20	22	11
Phase 3: Negotiation of meaning and co-construction of knowledge • Negotiation, identification of common ground, joint meaning making, statements of compromise	6	9	5
Phase 4: Testing and revision of ideas • Testing of ideas, hypotheses etc against personal knowledge	5	3	2
Phase 5: Awareness of newly constructed knowledge • Metacognitive statements, reflection, summarisation of agreement	0	0	1

*n= number of statements in this category

The results indicate that most of the forum messages were in the first category of *comparing* and *sharing information*. These interactions were forms of social interchange between group participants. There was little evidence of construction of new knowledge, critical analysis of ideas or instances of negotiation. Instead, it could be concluded that the majority of on-line interactions were related to the elaboration of existing beliefs and knowledge (Table 3). This exchange of information consolidated participants' existing knowledge schemata and therefore fulfilled an important aspect of the learning experience. While this kind of learning activity added little to the knowledge base, it nevertheless offered a forum for display of existing knowledge. The forum did not appear to foster testing and revision of ideas and negotiation of meaning. Table 3 shows that only a small percentage of contributions could be categorised as revision of ideas and awareness of knowledge building.

Student perceptions of the discussion forum

The responses to the survey instrument were tabulated and displayed using descriptive statistics. The survey instrument was designed to determine learner perceptions of the conferencing experience, and to explore student attitudes to the dimensions of knowledge building and support for group work in the forum (Table 2). Responses to the survey provided insight into learners' perceptions of the knowledge construction opportunities and group work on-line. The results of the questionnaire were very positive, showing that students found the discussions relevant, engaging, a source of new ideas and capable of increasing understanding (Figure 2). However, if we compare these responses to the quality of the on-line interactions there is a discrepancy between student perceptions of the forum and the actual quality of talk that occurred. Table 3 shows that the majority of exchanges did not contribute to new knowledge or to revision, challenging of ideas or reflection.

With respect to group work, students perceived the forum as affording opportunities for group discussion, clarifying ideas, teamwork and group feedback (Figure 2). The open-ended questions showed that students considered the process very time-consuming, but appreciated its capacity as a communication tool. The social processes of interaction were valued by the participants, but this does not imply that knowledge construction or reflection occurred as result of the verbal interchanges that eventuated.

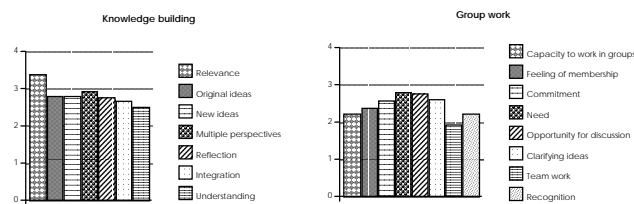


Figure 2: Summary of student responses to the group work and knowledge building dimensions of the forum

Discussion

In summary, the analysis of data gathered from the transcripts showed that participants engaged in display of information, comparison of ideas and elaboration of personal knowledge during the forum discussions. The processes underlying these exchanges were social and participatory, and did not involve learners in cognitive conflict, challenging or revision of ideas. According to constructivist theory, knowledge building involves learners in negotiation of meaning, reasoning and reflection on authentic tasks and engagement in conversation where knowledge is revised (Laurillard, 1995). These processes were not evident in the dialogue, although student perceptions of the discussion forum showed that they were positive and committed to group processes. The forum was supportive of group dialogue, social cohesion and sharing of ideas, and for many learners these aspects of on-line dialogue consolidated concepts and ideas.

Several hypotheses can be generated as to why the majority of interchanges remained at the level of comparing and sharing of ideas. One was that students in teams moderated the discussions, and there was little intervention by teachers to steer the discussion towards deeper levels of inquiry or to engage learners in critical analysis of each other's ideas. Participants stayed in their comfort zones, and did not question their own and others' ideas. A second hypothesis is that student roles in the team-based approach adopted for the forum did not encourage deeper levels of engagement because roles and activities were predefined. Typically, each week a team of students devised the questions, introduced the topic and provided a summary of discussion. This structure replicated a teacher-centered approach where the students waited for questions, responded to what was asked, and then waited for the surrogate teacher to summarise and give the 'big picture'. The fact that this pattern of interaction characterised the discussion forum for the entire duration of the course may have conditioned participants to engage in surface level processing and display of knowledge, in the manner in which the traditional didactic paradigm work (Gibbs, 1992).

Implications for practice

The study provides evidence that if forum discussions are to become knowledge construction events, we need to re-educate learners in the processes of engagement with ideas, critical analysis of their own views and revision of concepts in the light of conflicting ideas. This could be achieved by the tutor modeling the kinds of processes that aim at inquiry into concepts, rather than display and comparison of existing ideas. It would also require students to learn how to articulate their current understandings and misconceptions. However, this process of articulation may be constrained by the need to socially edit one's contribution in order to appear 'correct' and to maintain the illusion of being knowledgeable. Affective concerns in relation to computer conferencing should also be considered, as social inhibitions may operate to constrain open inquiry and construction of new ideas, particularly if all contributions are being assessed.

If we value constructivist learning at university, we need to address the question of how to evaluate learning processes in ways that recognise how knowledge is constructed. If we reflect on the fact that every definition of constructivism refers to active knowledge creation and not reproduction of information, we realise that learners must engage in intentional, authentic contexts for learning where they are required to construct new knowledge. These principles are illustrated in Figure 3, which presents a number of pedagogical approaches that could be applied in the design and management of on-line discussion forums.

Based on the findings from this research study and using Figure 3 as a model, the following aspects would be implemented in the next revision of the course:

1. A collaborative on-line environment with discussion forums that foster social interchange and communication about ideas and viewpoints will be supported and encouraged. Student contributions to these discussions will be assessed according to the analytic model developed by Gundwardena, Lowe and Anderson (1997).
2. An authentic context using case-based scenarios or real world problems will be created to generate revision of ideas. For example, rather than students researching a topic (with the use of text books, readers and guide) and posing questions, they will be given a 'real' problem, largely ill-defined, which will enable them to use problem solving skills to foster collaborative processes that

support engagement in the creation of new knowledge and consideration of differing viewpoints and perspectives.

3. Tutor scaffolding of inquiry and criticism of ideas needs to be more prominent in the process in order to help engage learners in higher order thinking. The tutor can model inquiry and multiple perspectives by going through the process of putting a solution to the problem on-line, moderating the discussion and then developing a summary of the different viewpoints and issues at the end of the week. In the following weeks each team then takes a turn presenting a solution to a problem. The tutor assists this team off-line, by mentoring students before they post their solution. Also, the tutor can play a more active role in the on-line discussion by playing 'devil's advocate' in order to promote deeper inquiry and challenging of different viewpoints and perspectives.
4. The students should be encouraged to engage with content at the higher levels shown as Table 3. This can be promoted through more explicit procedures for student participation and assessment. Moderation of discussion and insertion of questions and prompts by a moderator, such as *What aspect of your solution would you be most critical of, given the summary of viewpoints now presented?* and *Given the conflicting viewpoints for this problem, how would you approach this situation next time?* would provide structure and direction to discussions.

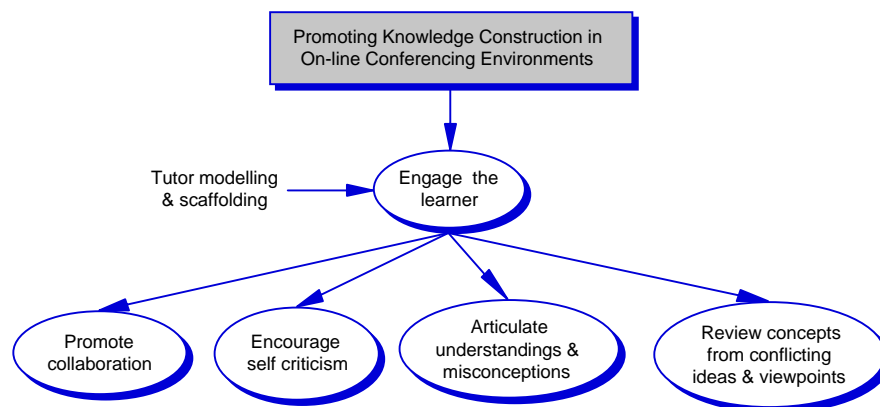


Figure 3: A model for promoting knowledge construction in an on-line environment

These pedagogies may mean that teachers assume a mentoring role initially in the forum discussion, but this support could be faded as students develop the skills of questioning, self-critical appraisal of ideas, and problem solving.

This initial study of a Web CT forum has yielded rich data and insights into student learning which are being evaluated in order to improve future learning on-line. The research so far has demonstrated that discussion forums may only provide limited learning opportunities. However, by integrating constructivist pedagogical principles, for example, by tutor modeling, scaffolding of inquiry and assigning tasks and roles on-line, computer conferencing can become a forum for knowledge creation and not merely an avenue for lonely and loquacious students.

References

- Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues, and the development of scientific reasoning. *Social development*, 2(3), 202-221.
- Candy, P. C. (1991). *Self-direction for lifelong learning: A comprehensive guide to theory and practice*. San Francisco: Jossey Bass.
- Crook, C. (1994). *Computers and the collaborative experience of learning*. London: Routledge.
- Eastmond, D. V. (1994). Adult distance study through computer conferencing. *American Journal of Distance Education*, 15(1), 128-152.
- Eastmond, D. V. (1995). *Alone but together: Adult distance education through computer conferencing*. Cresskill, New Jersey: Hampton Press.
- Edwards, A. D., & Westgate, D. P. G. (1994). *Investigating classroom talk* (Revised and extended second edition ed.). London: The Falmer Press.
- Flanders, N. (1970). *Analysing teaching behaviour*. Reading, Mass: Addison Wesley.
- Forman, E. A., Minick, N., & Stone, C. A. (1993). *Contexts for learning*. New York: Oxford University Press.
- Gibbs, G. (1992). *Discussion with more students*. Cambridge: Oxonian Rewley Press.
- Gunawardena, C., Lowe, C., & Anderson, T. (1997). Analysis of a global on-line debate and the development of an interaction analysis model for examining the social construction of knowledge in computer conferencing. *Journal of Educational Computing Research*, 17(4), 397-431.
- Harasim, L. (1989). On-line education: A new domain. In R. Mason & A. Kaye (Eds.), *Mindweave; Communication, computers and distance education* (pp. 50-62). Oxford: Pergamon Press.
- Harasim, L. (Ed.). (1994). *Global networks: Computers and international communication*. Cambridge, Mass.: The MIT Press.
- Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1995). *Learning networks: A field guide to learning on-line*. Cambridge, MA: MIT Press.
- Henri, F. (1992). Computer conferencing and content analysis. In A. R. Kaye (Eds.), *Collaborative Learning Through Computer Conferencing* (pp. 117-136). Berlin: Springer-Verlag.
- Hiltz, S. R. (1994). *The virtual classroom: Learning without limits via computer networks*. Norwood, New Jersey: Ablex Publishing Corporation.
- John-Steiner, V., & Mahn, H. (1996). Socio-cultural approaches to learning and development: A Vygotskian framework. *Educational Psychologist*, 31(3/4), 191-206.
- John-Steiner, V., Panofsky, C. P., & Smith, L. W. (1994). *Socio-cultural approaches to language and literacy*. Cambridge: Cambridge University Press.
- Jones, A., & Mercer, N. (1993). Theories of learning and information technology. In P. Scrimshaw (Eds.), *Language, classrooms and computers* (pp. 11-26). London: Routledge.
- Kumpulainen, K. (1996). The nature of interaction in the social context created by the use of word processors. *Learning and Instruction*, 6(3), 243-261.
- Laurillard, D. (1995). Multimedia and the changing experience of the learner. *British Journal of Educational Technology*, 26(3), 179-189.
- McLoughlin, C., & Oliver, R. (1998). Maximising the language and learning link in computer learning environments. *British Journal of Educational Technology*, 29(2), 125-136.
- Mercer, N. (1993). Computer-based activities in classroom contexts. In P. Scrimshaw (Eds.), *Language, Classrooms and Computers* (pp. 27-39). London: Routledge.
- Mercer, N. (1994). Neo Vygotskian theory and classroom education. In B. Stierer & J. Maybin (Eds.), *Language, Literacy and Learning in Educational Practice* (pp. 92-110). Clevendon: Multilingual Matters.
- Moll, L. C. (Ed.). (1990). *Vygotsky and education: Instructional implications and applications of socio-historical psychology*. Cambridge: Cambridge University Press.
- Nastasi, B. K., & Clements, D. H. (1992). Social-cognitive behaviours and higher order thinking in educational computer environments. *Learning and Instruction*, 2, 215-238.
- Saljo, R. (1994). Adult practices and children's learning: Communication and the appropriation of cultural tools. *European Journal of Psychology of Education*, 9(2), 87-91.
- Tinkler, D., Lepani, B., & Mitchell, J. (1996). *Education and technology convergence*. Canberra: Australian Government Publishing Service.
- Wertsch, J. V. (Ed.). (1985). *Culture, communication and cognition*. Cambridge: Cambridge University Press.
- Vygotsky, L. (1978). *Mind in society: the development of higher psychological processes*. Cambridge MA: Harvard University Press. (Original material published in 1930, 1933 and 1935).
- Vygotsky, L. (1986). *Thought and language*. Cambridge MA: MIT Press.

The author(s) assign to ASCILITE and educational non-profit institutions a non-exclusive license to use this document for personal use and in course of instruction provided that the article is used in full and this copyright statement is reproduced.

The author(s) also grant a non-exclusive license to ASCILITE to publish this document in full on the World Wide Web (prime sites and mirrors) and in printed form within the ASCILITE99 Conference Proceedings. Any other usage is prohibited without the express permission of the author(s).