



Analyzing CMC content for what?

Som Naidu ^{a,*,1}, Sanna Järvelä ^b

^a *The University of Melbourne, Information and Education Services, Elizabeth Murdoch Building, 3010 Victoria, Australia*

^b *University of Oulu, Finland*

Abstract

Computer mediated communication (CMC) refers to communication between individuals and among groups via networked computers. Such forms of communication can be *asynchronous* or *synchronous* and serve a wide variety of useful functions ranging from administration to building understanding and knowledge. As such there are many reasons for interest in analyzing the content of CMC. Foremost among these is the opportunity that the written text is able to offer for various types of analysis. Others have to do with the need to understand human communication patterns in this medium, their conventions, form and functions, the nature of the subtext within it, and how people derive meaning and understanding in such contexts. The papers in this special section of this journal have attempted to closely examine the subject of CMC content analysis. It includes examination of what is involved in the analysis of CMC content, schemes and frameworks for analyzing them, and knowledge building within such contexts.

© 2005 Elsevier Ltd. All rights reserved.

Keywords: Computer-mediated-communication; Computer supported collaborative learning; Empirical evidence

1. Why analyze CMC content?

The reasons for interest in analyzing the content of computer-mediated communication (CMC) are wide ranging. Foremost among these is the opportunity that the written text is able to offer for

* Corresponding author. Tel.: +61 3 8344 7575; fax: +61 3 8344 4341.

E-mail address: s.naidu@unimelb.edu.au (S. Naidu).

¹ Executive Editor of the journal *Distance Education* and a Series Editor of the RoutledgeFalmer book series on Open and Flexible Learning published by the Taylor and Francis Group.

various types of analysis. Others have to do with the need to understand human communication patterns in this medium, their conventions, form and functions, the nature of the subtext within it, and how people derive meaning and understanding in such contexts. This understanding is considered important because of the growing use of computer-mediated communications in current educational settings.

The need to understand human communication patterns is not new. Researchers in the areas of reading comprehension and discourse analysis have long sought to understand the written as well as the oral text using various units of analysis such as facts, concepts, principles, arguments, proposition and idea units. See for instance, [Armbruster and Anderson \(1982\)](#), and [Mayer \(1984\)](#). Experience and expertise developed as part of this foregoing research on prose and discourse analysis has obvious relevance for the analysis of computer-mediated communication content.

However, the nature of computer-mediated communications is such that it offers a completely new range of opportunities and possibilities, and that is what is occupying the interests of growing numbers of researchers in the field (e.g. [De Wever, Schellens, Valcke, & Van Keer, 2005](#); [Schrire, 2005](#); [Strijbos, Martens, Prins, Wim, & Jochems; Weinberger & Fischer, 2005](#)).

2. What should be understood?

Computer-supported collaborative learning and the use of networked technology, has been a very popular trend in research and design of learning environments during the past years ([De Corte, Verschaffel, Entwistle, & Van Merriëboer, 2003](#); [Strijbos, Kirschner, & Martens, 2004](#)). But empirical research has shown that there is no guarantee that networked collaboration leads to higher level understanding, and that all individuals of the community reciprocally participate in new knowledge creation ([Järvelä & Häkkinen, 2002](#); [Leinonen, Järvelä, & Lipponen, 2003](#)). If collaborative learning is aimed with CMC and CSCL a very realistic approach in terms of success of collaboration should be taken.

One of the misleading interpretations in many implementations of collaborative learning is that collaborative learning with respect to processes and outcomes is desirable as such. At its best, collaborative learning situations seem to provide a natural setting for self-explanation and explaining to others as well as other forms of knowledge articulation, which have shown to demonstrate positive effects for learning ([Miyake, 1986](#); [Roschelle & Teasley, 1995](#)). Thus, CMC and CSCL interactions should be analyzed as a means of gaining insight into the processes of collaborative learning and trying to clarify what constitutes productive collaborative activity. This is to say, for example, how can technology better enable participants to find each other and form collaborative groups around mutual interests, skills, and needs in distributed teams?, or, What is the role of interactions for supporting productive joint engagement and shared understanding? Especially today, when we have variety of interactivity, mobility, visualizations and multimedia available for the use of CMC and CSCL (e.g. [Barab, Kling, & Gray, 2004](#); [Zurita & Nussbaum, 2004](#)) we should focus on investigating variety of possibilities these environments make us interact, collaborate and share ideas. How and what kind new opportunities for interaction these environments provide? Can interaction be more rich in the service of learning when it is not spatial (in terms of teacher–student interaction or classroom discourse), but virtual, asynchronous, multimediated and not linear?

3. Computer mediated communications

Computer mediated communication is a generic term that incorporates all forms of communication between individuals and among groups via networked computers. Such forms of communication can be *asynchronous* or *synchronous*. In the asynchronous mode, the parties involved are logged on at different times, and in the synchronous mode, they are logged on at the same time and reacting to each other's messages as these are received. Synchronous CMC is similar to a telephone conversation except that much of the communication mode in the former is text-based while in the latter it is voice-based. In the asynchronous mode, those who wish to communicate with others can do so in their own time and place without the need for face-to-face contact. This is advantageous to many people both in administrative and academic situations. Managers and administrators are able to make use of this facility for meetings while instructors and students are able to use it for teaching and learning purposes. Users can post their comments on new and ongoing issues in their own time where these are stored for others to view, react to and review over and over.

The learning and instructional applications of computer mediated communications (e.g., e-mail, text-based conferencing, bulletin boards) has been growing steadily over the last couple of decades (see Bates, 1990; Harasim, 1993; Mason, 1993; Mason & Kaye, 1989; Rapaport, 1991). However, within this burgeoning interest and use of CMC for educational purposes, there is a wide range of applications including chat (open-ended as well as focused), socializations and more focused discussion of subject matter content and various types of assessment tasks. Each form of application serves a unique set of purposes. This means that not every application of CMC can be analyzed in the same way. Strategies for the analysis of a particular type of CMC application will have to be carefully selected or developed in alignment with the purposes that the conversation is designed to engender. Furthermore, care needs to be exercised against over analyzing CMC content, or attempting to apply overly reductionist strategies to the study of a rather complex communication channel (Hemelo-Silver, 2003; Schrire, 2005).

The papers in this special section of this journal have attempted to closely examine the subject of CMC content analysis. The authors of the various papers in this special section and their editors have done a tremendous job in carefully orchestrating this discussion on the subject. It includes examination, very importantly, of what is involved in the analysis of CMC content, schemes and frameworks for analyzing them, and knowledge building within such contexts. As such, the papers in this special section comprise a significant contribution on the subject of CMC content analysis.

A clear message that is coming out of this discussion is that CMC content analysis strategies and instruments ought to be accurate, precise, objective, reliable, replicable and valid (Strijbos et al., 2005). Furthermore that the procedure for CMC content analysis should comprise, at least, the following critical steps:

- Determination of the unit of analysis;
- Development of segmentation procedure;
- Determination of the reliability of the segmentation procedure;
- Development of coding categories and rules; and
- Determination of the reliability of the coding categories.

It is also argued that the strategies and instruments ought to have a theoretical base possibly derived from communication theories (Stahl, 2004). There is also a call for a strong theoretical base to guide research into the analysis of CMC content. Many of the studies in this area rarely go beyond a case study report, although several studies have made landmark contributions such as that of Henri (1991).

Many reasons can be, and have been put forth to explain the poor quality of much of the research effort in this area. The main reasons have to do with the relative immaturity of this area of investigation. Serious use of computer-mediated communications has been around for a little over a decade. For this reason, and also because of the wide-ranging use and application of CMC, researchers have had difficulty in identifying one or more coherent theoretical bases from which research in this area can draw. This in turn affects the emergence or the development of clear approaches and paradigms for studying CMC. Therefore, and no doubt, much of the research effort is confined to case study reports. Experimental studies incorporating hypothesis testing are usually unsuited and harder to carry out in such settings, although there are emerging some instances of hypothesis testing (Beuchat & Bullen, 2005).

It is arguable that a search for a theoretical base for research into computer mediated communications is rather far-fetched and unrealistic. After all CMC is not much more than writing short letters via networked computers. Yet, it is different from writing paper-based letters because CMC has a unique set of forms, norms and conventions somewhat similar to mobile phone-based short messaging system (SMS). In addition, and unlike SMS (to date), computer-mediated communication can be a very directed activity when it is focussed on the understanding of a body of subject matter content or the pursuit of some project. In this case the approach to the analysis of that content takes on new meaning, as it is driven by very specific and particular learning outcomes. In that case broad-based studies of group and other indices of human behavior are irrelevant. For these reasons, the study of CMC content deserves serious attention.

4. Computer supported collaborative learning

When computer-mediated communication involves some kind of collaborative learning activity, it is called “computer supported collaborative learning” (CSCL). The collaborative learning activity in this case is what would distinguish it from other forms of computer-mediated communications. CSCL is a purpose driven activity in which the objective is to engender group processes.

Collaboration lies at the heart of CSCL. Collaboration comprises sharing of information, expertise and experience. There can be many types of collaborative activity and which may manifest itself in several ways while serving many different functions. For instance, collaboration could serve as “a culturative process, which helps participants to become members of knowledge communities that are different from knowledge communities they already belong to” (Bruffee, 1993, p. 3). Collaboration can also be described as “the mutual engagement of participants in a coordinated effort to solve a problem together” (Roschelle & Behrend, 1995, p. 70).

This latter interpretation of collaboration highlights several critical features of the concept. These are: an approach to learning that is based on doing something; the engagement of learners in cooperative as opposed to competitive behavior; and a shift in the instructor’s role from serving

as the provider of information to being a facilitator of the collaborative process. Some examples of collaborative learning activities include group-based investigation or inquiry (Sharan, 1980), problem-based learning (Barrows, 1994; Koschmann, Kelson, Feltovich, & Barrows, 1996), and project-based learning, (Blumenfeld et al., 1991). Collaborative traits are learned behaviors. Characteristics of this trait include a willingness to share, demonstration of respect towards alternative views and dispositions, and ability to listen carefully and attentively (Koschmann, 1996).

The nature of collaboration must be the focus of our research effort into CMC content. There is a need to move beyond a focus on such things as counting of idea units etc in CMC content to directing attention on the purpose of CMC. In this line of research the more interesting research questions in the study of CMC are as follows:

- What are the successful and critical attributes of CSCL environments?
- What are the successful and critical attributes of collaborative learners?
- How can one generate and engender these “attributes and behaviors” in CSCL environments and the learners, such as:
 - Sharing of practical learning experiences;
 - Engagement in collaborative and reflective learning activities;
 - Use of reflection and practical experience to build understanding; and
 - Moving from a position of independent study to collaborative learning and towards a networked community of learners?

Obviously this will have a bearing on careful design of CMC environments, as not all of such settings will be worthy of this kind of close scrutiny, and that would itself, comprise a most desirable outcome. The use of computer mediated communication in the learning and teaching experience by itself cannot cause significant changes to occur in the quality of learning and teaching. Like any other media, CMC has to be carefully integrated into the educational activity. Moreover, this goal has to be central to the total educational experience of students, and not be seen as obligatory or optional learning activity. The completion of the CMC tasks as a part of this designed learning experience must have explicit rewards for the students or else they would not be inclined to spend time on it.

5. Contextual perspective – where is the evidence of CSCL and CMC learning?

In late 90's educational psychologists' interest in contexts reflects trends in the study of cognitive development that emphasize the social nature of human learning (De Corte, 2000). During the recent years there has been a lively discussion on whether we should follow individual or social perspectives on activity and should we conceptualize the current understanding on situative or cognitive approaches (e.g. Anderson, Greeno, Reder, & Simon, 2000). Through the influence of sociocultural and situated cognition theories, it has been recognized that individual learners are also influenced by social values and the context in which the learning takes place. Cognition and social interaction is no more a separate variable or a distinct factor, which can be applied in explanation of an individual readiness to act or learn – but reflective of the social and cultural

environment. Taken this recent “situative” perspective on learning and current development of analyses of on-line learning it is obvious that contextual perspective in analyses of CMC and CSCL are still rare. Despite of many innovative new ways to support human cognition and learning with technology the problematic nature of investigating human learning still remains: it is always a matter of complex interaction of cognitive and social actions, motivational and emotional aspects and the features of the learning context.

Keeping the complex characteristic of human learning in mind, it is never possible to find full evidence of learning from “traces”, such as computer notes of discussion threads, even though detailed analyses (as reported in this Special Issue) can inform us some of critical processes of collaboration or argumentation. More contextual perspective on analysing CSCL and CMC is still needed. What is the role of computer mediated communication for students’ contextual activities in face to face and social situations? What are the discussions by the computer or in a classroom activated by the computer mediated communication? For what kind of “off-line” study processes students in a virtual course are stimulated? These are, for example, questions which should be also asked and new methods found to combine on-line and off-line student activity in order to understand the purpose of CMC for students learning. It is obvious (e.g. Schrire, 2005) that the data from multiple sources need be utilized to enable a mixed method approach in order to gain better understanding on how individual’s dispositional characters and situational appraisals as well as features of a learning environment interact in evolving engagement in dynamic contexts of learning.

6. Conclusion

The papers in this special section of this journal comprise a significant contribution in this regard, as they question the limitations of contemporary approaches to CMC content analysis, and explore approaches to content analysis and knowledge building in CMC learning environments.

Consistent across papers, is the claim that using multiple methodologies is beneficial to better understand learning in dynamic on-line learning contexts. Combining methodologies from different research traditions has been found useful to reveal ambiguities, contradictions and paradoxes, which in turn have led to new conceptual developments, but also increased dangers for confusions in different epistemological perspectives. From a pragmatic perspective, it may be more important to mix research traditions, especially if the aim is to improve understanding and ultimately educational practice – but still not in the cost of theoretical coherence or validity of empirical research as strongly emphasized in this special issue.

References

- Anderson, J. R., Greeno, J. G., Reder, L. M., & Simon, H. A. (2000). Perspectives on learning, thinking, and activity. *Educational Researcher*, 29, 11–13.
- Armbruster, B., & Anderson, T. (1982). *Idea-mapping technique and its use in the classroom or simulating the “ups” and “downs” of reading comprehension*, Reading Report Education Report No. 36. Urbana-Campaign, IL: University of Illinois Press.

- Barab, S. A., Kling, R., & Gray, J. (Eds.). (2004). *Designing for virtual communities in the service of learning*. Cambridge, MA: Cambridge University Press.
- Barrows, H. S. (1994). *Practice-based learning: Problem based-learning applied to medical education*. Springfield, IL: Southern Illinois University School of Medicine.
- Bates, A. W. (Ed.). (1990). Media and technology in European distance education. In *Proceedings of the EADTU workshop on media, methods and technology*. Heerlen, The Netherlands: European Association of Distance Teaching Universities.
- Beuchat, A., & Bullen, M. (2005). Interaction and interpersonality in online discussion forums. *Distance Education*, 26(1), in press.
- Blumenfeld, P., Soloway, E., Marx, R., Krajcik, J., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: sustaining the doing, supporting the learning. *Educational Psychologist*, 26, 369–398.
- Bruffee, K. (1993). *Collaborative learning*. Baltimore: Johns Hopkins Press.
- De Corte, E. (2000). Marrying theory building and the improvement of school practice: a permanent challenge for instructional psychology. *Learning and Instruction*, 10(3), 249–266.
- De Corte, E., Verschaffel, L., Entwistle, N., & Van Merriëboer, J. (Eds.). (2003). *Unravelling basic components and dimensions of powerful learning environments*. Elsevier.
- De Wever, B., Schellens, T., Valcke, M., & Van Keer, H. (2005). Content analysis schemes to analyze transcripts of online asynchronous discussion groups: A review. *Computers & Education*, 46(1), 6–28.
- Harasim, L. (Ed.). (1993). *Global networks: Computers and international communication*. Cambridge, MA: The MIT Press.
- Hemelo-Silver, C. E. (2003). Analyzing collaborative knowledge construction: multiple methods for integrating understanding. *Computer & Education*, 41(4), 397–420.
- Henri, F. (1991). Computer conferencing and content analysis. In A. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden papers* (pp. 117–136). London: Springer-Verlag.
- Järvelä, S., & Häkkinen, P. (2002). Web-based cases in teaching and learning – the quality of discussions and a stage of perspective taking in asynchronous communication. *Interactive Learning Environments*, 10(1), 1–22.
- Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Koschmann, T., Kelson, A. C., Feltovich, P. J., & Barrows, H. S. (1996). Computer-supported problem-based learning: A principled approach to the use of computers in education. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Leinonen, P., Järvelä, S., & Lipponen, L. (2003). Individual students' interpretations of their contribution to the computer-mediated discussions. *Journal of Interactive Learning Research*, 14(1), 99–122.
- Mason, R. (Ed.). (1993). *Computer conferencing: The last word*. Victoria, British Columbia, Canada: Beach Holme Publishers Limited.
- Mason, R., & Kaye, A. (Eds.). (1989). *Mindweave: Communication, computers and distance education*. Oxford, UK: Pergamon Press.
- Mayer, R. E. (1984). Aids to text comprehension. *Educational Psychologist*, 19(Winter), 30–42.
- Miyake, N. (1986). Constructive interaction and the iterative process of understanding. *Cognitive Science*, 10, 151–177.
- Rapaport, M. (1991). *Computer mediated communication*. New York: John Wiley & Sons, Inc.
- Roschelle, J., & Teasley, S. (1995). The construction of shared knowledge in collaborative problem solving. In C. E. O'Malley (Ed.), *Computer supported collaborative learning*. Heidelberg: Springer-Verlag.
- Roschelle, J., & Behrend, S. (1995). The construction of shared knowledge in collaborative problem solving. In C. O'Malley (Ed.), *Computer-supported collaborative learning* (pp. 69–97). Berlin: Springer-Verlag.
- Schrire, S. (2005). Knowledge-building in asynchronous discussion groups: Going beyond quantitative analysis. *Computers & Education*, 46(1), 49–70.
- Sharan, S. (1980). Cooperative learning in small groups: recent methods and effects on achievement, attitudes, and ethnic relations. *Review of Educational Research*, 50, 241–271.
- Stahl, G. (2004). Building collaborative knowing: Contributions to a social theory of CSCL. In J. W. Strijbos, P. Kirschner, & R. L. Martens (Eds.), *What we know about CSCL in higher education*. Amsterdam: Kluwer.

- Strijbos, J.-W., Martens, R. L., Prins, F. J., & Jochems, W. M. G. (2005). Content analysis: What are they talking about? *Computers & Education*, 46(1), 29–48.
- Strijbos, J.-W., Kirschner, P. A., & Martens, R. L. (Eds.). (2004). *What we know about CSCL: And implementing it in higher education*. Boston, MA: Kluwer.
- Weinberger, A., & Fischer, F. (2005). A framework for analysing argumentative knowledge construction in computer-supported collaborative learning. *Computers & Education*, 46(1), 71–95.
- Zurita, G., & Nussbaum, M. (2004). Computer supported collaborative learning using wirelessly interconnected handheld computers. *Computers & Education*, 42(3), 289–314.