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Toward a Conversation System Modeling Research Methodology for Studying Computer-Mediated Learning Communities

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Abstract

The purpose of this article is to examine methodological challenges in the study of computer-mediated learning communities and propose strategies for advancing research methodology. Two major methodological issues are addressed. First, there is a growing concern for researchers to address a broader range of social, political, and cultural factors when studying computer-mediated learning communities. A second and related problem concerns challenges about the measurement of learning processes and interactions in computer-mediated learning communities. Advances in second-order cybernetics (Krippendorff, 1991, 1994) and language pragmatics (Searle, 1969) are explored in relation to research methodology requirements for studying computer-mediated learning communities. A conversational system modeling (CSM) strategy is offered as a guide for researchers studying computer-mediated learning communities. The assumption is that learning communities are embedded in complex conversations and sociopolitical and sociocultural influences that must be addressed by research on CMC learning environments.

Résumé

Le but de cet article est d'examiner les défis méthodologiques dans l'étude de communautés d'apprentissage assistées par ordinateur et propose des stratégies pour faire avancer la méthodologie de recherche. Deux grandes questions méthodologiques sont abordées. Premièrement, il y a chez les chercheurs un souci grandissant d'aborder, dans l'étude des communautés d'apprentissage assistées par ordinateur, un éventail plus grand de facteurs sociaux, politiques et culturels. Un second problème, relié au premier, concerne les défis dans la mesure des processus d'apprentissage et des interactions dans les communautés d'apprentissage assistées par ordinateur. Les progrès dans la cybernétique de deuxième niveau (second-order) (Krippendorff, 1991, 1994) et la pragmatique du langage (Searle, 1969) sont explorés en relation avec les exigences de méthodologie de recherche dans l'étude des communautés d'apprentissage assistées par ordinateur. Un système de modélisation conversationnel (CSM) L'hypothèse est que les communautés d'apprentissage sont plongées dans des conversations complexes et imprégnées d'influences

sociopolitiques et socioculturelles dont doivent tenir compte les recherches sur les environnements des communautés d'apprentissage assistées par ordinateur.

Introduction

Computer-mediated communication (CMC) has quickly become a major research and development area for many professionals. Many institutions of higher education are looking to CMC, particularly computer conferencing, as a versatile medium for the delivery of educational programs that are inexpensive, widely available, accessible at all times, and allow for greater collaborative opportunities. CMC offers a different medium than the traditional classroom, with a potentially richer opportunity for student interaction. Asynchronous communication allows for high degrees of participant reflection. The flexibility of CMC allows for quicker feedback and a greater number of communicative exchanges in a shorter time. The capacity of CMC for user anonymity reduces potential power struggles or discrimination due to race, sex, or social position.

Computer-mediated instruction is employed to promote experiential learning, collaboration, and multiple perspective-sharing (Dehler & Porras-Hernandez, 1998). Increasing use of the Internet to facilitate collaborative learning overcomes the temporal and geographic boundaries that limit traditional classrooms. As interaction becomes increasingly more flexible and geographic and temporal borders are overcome, there is greater opportunity for collaborative learning. However, this also leads to the simultaneous creation of more complex and multifaceted learning environments to study. This begs the question regarding whether current research methodology can provide the right kinds of knowledge needed to inform future developments in computer-mediated learning.

The focus of this article is limited to exploring major challenges to research methodology as it relates to the study of computer-mediated learning communities. The article is divided into three sections that address specific issues, namely, (a) methodological issues in the study of computer-mediated learning communities, (b) innovations in research methodology, and (c) positing of a Conversation System Model (CSM) as a potential guide for advancing research methodology in the study of computer-mediated learning communities.

Methodological Issues in the Study of Computer-Mediated Learning Communities

Computer-Mediated Learning Communities

What is the nature of computer-mediated learning communities? Computer-mediated learning communities are largely based in situated cognition theory characterized by active engagement, discovery learning,

sociocultural context, and co-construction of knowledge in knowledge communities or communities of practice (Kirshner & Whitson, 1998; Lave & Wenger, 1991; Wenger, 1998). Some of the major thinkers attached to the antecedents are Gibson, Dewey, Pierce, Lewin, Mead, Vytgotsky, and Bourdieu (Kirshner & Whitson, 1997). The presupposition of *situation* as essentially a matter of physical time and space common to early situated cognition discourses is no longer applicable. Recent developments in research and technology challenge researchers to think about cognition and community in ways that transcend such physiotemporal domination (Kirscher & Whitson, 1998).

The notion of knowledge as a lived experience and the notion of learning as contextualized in sociopolitical and sociocultural spaces are two common themes linked to communities of learning. Knowledge is a dialectic process, the essence of which is that individuals have opportunities to test their constructed ideas on others, persuade others of the virtues of their thinking and be persuaded (Cognition and Technology Group at Vanderbilt, 1991). This notion of knowledge shifts attention to the sociocultural setting and the activities of the people in it. Knowledge emerges from lived social practices and can be fully understood in relation to those practices. Sociopolitical and sociocultural considerations are implicated in communities of learning (Archer, Garrison, Anderson, & Rurke, 2001).

Recent directions in CMC research incorporate sociopolitical and cultural influences on computer-mediated learning communities in higher education. Gunawardena et al. (2001) compare perceptions of on-line group processes and development between participants in Mexico and the United States in a mixed-method case study. Samples from students at universities in New Mexico and Mexico were selected for comparison by using citizenship as a determinant for cultural status. The authors found that groups differed significantly in perceptions of language, power distance, gender differences, collectivist vs. individualist tendencies, conflict, social presence, time frame, and technical skills. Although country differences did account for group differences in this case study, there were challenges in finding appropriate samples for cross-cultural comparison. Also, the increasing internationalization of institutions of higher education blur cultural boundaries determined by geography.

The cultural and political dimensions of computer-mediated learning communities are becoming especially important amid increasing internationalization and localization of postsecondary institutions and growth in e-learning (DeBry, 2001). This raises a number of pertinent research methodology questions about the study of computer-mediated learning communities. What instrumentation exists for studying learning processes and exchanges in computer-mediated learning communities? How can

sociopolitical and sociocultural influences be integrated into research methodologies for computer-mediated learning communities?

Researching Computer-Mediated Learning Communities

How to measure learning processes and interactions is a fundamental concern for researchers who study computer-mediated learning communities. Content analysis is a widely applied research tool for studying learning processes and interactions in computer-mediated learning communities (Bullen, 1998; Garrison et al., 2000; Newman, Johnson, Cochrane, & Webb, 1996; Weiss, & Morrison, 1998). Various theoretical approaches to quantitative content analysis have been applied to the study of CMC: cognitivist-behaviorist (Archer et al., 2001; Garrison, et al., 2000), constructivist (Kanuka & Anderson, 1998) and mixed approaches (Henri, 1991; Bullen, 1998).

Attempts to measure on-line activity, however, reveal serious methodological stumbling blocks in the analysis of the text-based conference transcripts (Rourke, Anderson, Garrison, & Archer, 2001). Two major challenges associated with coding schemes are replicability and meaningfulness. Rouke et al. surveyed 19 CMC research studies that employed quantitative content analysis and found no successful attempts to replicate earlier findings. They discovered serious problems such as low instrument reliability and failures to report interrater reliability in a survey of research on CMC learning environments. Second, there is a problem of meaning associated with coding units themselves. Manifest content coding units (e.g., words, phrases, paragraphs, etc.) measure surface meaning and can be easily reproduced by independent raters (Holsti, 1969). Some questions cannot, however, be addressed through surface meaning. It is more difficult for independent raters to reproduce latent content coding units (e.g., thematic units) intended to measure more covert and complex variables such as higher-order learning:

> Fixed units such as single words or entire messages are objectively recognizable, but they do not always properly encompass the construct under investigation. Dynamic units such as Henri's (1991) "units of meaning" properly delimit the construct, but invite subjective and inconsistent identification of the unit. (Rourke et al., 2001, p. 11)

One set of studies (Garrison et al., 2000) examined factors that affect social presence in CMC environments by applying behavioral indicators of social presence (i.e., emotional expression, group cohesion, open communication) to the analysis of a university student computer conference. Results of the study demonstrated that social presence influences the fulfillment of cognitive objectives and critical thinking. Rouke et al. (2001) built on Garrison et al. (2000) by examining the magnitude of social

presence indicators in a computer conference. Both studies operationalize "social presence" by adding the total number of social presence indicators (i.e., continuing a message thread, quoting others in group, complimenting, etc.) and dividing them by the number of words to obtain a social aggregate ratio. Survey results indicate that certain social expressions are related to more positive ratings of the social climate. This line of research on social presence is more amenable to aims of generalizable research. However, it omits the qualitative analysis required to detect unique nonprescribed social responses and social responses that emerge as a result of conference participation patterns.

There is a recognized need to advance research by better corroborating latent and manifest content analysis. Hosti (1969) suggests that one way to overcome the problem of latent content coding reproduction is to postpone it to a later stage of analysis. Weiss and Morrison (1998) employ latent analysis in the final stages of research to draw associations between latent variables and manifest behaviors coded at an earlier stage of research. Attempts at corroborating latent and manifest content indicate an invested effort to produce research that is both meaningful and reliable. This challenges researchers' ability to ensure that research methods are both reliable and meaningful.

Summary. Recent technological developments redefine the boundaries of learning communities fundamentally by providing more opportunities and greater flexibility in learning communities. An understanding of computer-mediated learning communities requires comprehension of active engagement, participation, and knowledge co-construction. It also requires attention to social, political, and cultural considerations that may influence computer-mediated learning communities. Researchers studying computer-mediated learning communities are challenged to develop research methods that are reliable and meaningful.

Innovations in Research Methodology

Speech and Conversation Analysis

Innovations from the area of language pragmatics appear to offer leverage to advance CMC research. Searle's (1969) speech act categories have been applied to computer-supported collaborative learning research (Chang & Woo, 1994; Winograd, 1988). Searle's Speech Act Theory classifies types of utterances into various classes based on what one can do with them. Searle divides speech acts into assertive, directive, and commissive classes. In the case of assertives, utterances commit the speaker to something being the case. In the case of commissives, utterances commit the speaker to some future action. In the case of directives, utterances attempt to get the hearer to do something. Directives include both questions (which can direct the hearer to respond) and commands (which can direct the hearer to perform

some act). Each act is qualitatively distinct and conveys a specific speaker's purpose in it (illocutionary unit). *Illocutionary unit* refers to the speaker's purpose expressed in individual speech acts and provides information about a speaker's purpose and the conditions that must be met for satisfaction to occur (Searle, 1969).

The application of other conversation taxonomies that appeared in recent CMC research publications offers researchers leverage for contributing research that is high in both meaning and experimental reliability. Poole and Holmes' (1995) decision development topology of conversation acts (i.e., problem definition, orientation, solution development, non-task, simple agreement, simple disagreement) is applied to computer-mediated group decision-making contexts (Jonassen & Kwon, 2001; Poole & Holmes, 1995). Jonassen and Kwon adapted Poole and Holmes' decision development topology to compare communication pattern interactions between face-to-face and computer-mediated group problem-solving. Such conversation taxonomies provide information about higher-order processes that most quantitative content analysis methods do not offer. In the case of Jonassen and Kwon's study, they were able to detect difference styles of group problem-solving conversations.

Although conversation taxonomies for coding on-line conference activity may overcome some limitations of current CMC research, problems of meaning are pervasive and cannot be completely resolved by focusing only on better content analysis strategies. This is because the design and implementation of computer-coordinated interventions rely on factors that go beyond content. Brown and Duguid's (1994) critical review of social, material, and political aspects of information technologies, research on cross-cultural / political influences on on-line collaborative learning (Gunawardena et al., 2001), and research on social factors that affect CMC environments (Rourke et al., 2001) are part of an increasing trend in CMC research to examine broader issues that correspond to complex and often implicit real-life differences and conflictual situations where individuals do not always share the same goals. *Tech Trends* (2002) dedicated an entire edition to minority issues in educational technology. Research trends highlight how important it is for research methodologies to address a broader range of questions and develop appropriate tools for studying participant diversity and change in on-line learning networks embedded in larger systems of influence.

Second-Order Cybernetic Modeling

A number of appropriate theoretical frameworks allow for the study of learning and social interaction in larger systems of influence. Action science, organizational dynamics, participatory action research, soft-systems theory, and second-order cybernetics are among a growing trend in

learning organization literature dedicated to the study of the development and evolution of learning organizations (Argyrus, Putnam, & Smith, 1987; Krippendorff, 1994; Senge, 1990). Such theoretical frameworks align with views of individuals as constituted through active engagement with others in social systems.

Second-order cybernetic epistemology views knowing as a process of continual construction that maintains itself in the presence of (enabling or frustrating) perturbations from the medium in which it resides. Knowledge is embedded in a circular social practice that involves thinking and acting beings (Krippendorff, 1991). Second-order cybernetic-based approaches are especially useful for studying learning organizations in the real world where negotiation, conflict, and sociopolitical influences affect learning objectives and performance outcomes. Integral to second-order cybernetic epistemology is the importance of self-reflexivity and participation of stakeholders in cyclical processes of knowledge creation. Iterative processes of planning, action, and evaluation are essential features of the operation of learning organizations in the real world. Cyclical processes allow for changes to be introduced and observed in the contexts studied. Feedback of findings to participants is essential for introducing changes into social contexts and making adjustments to satisfy those who are affected. Negotiation and conflict resolution are essential components in real life where individuals have different goals in social contexts. It is essential to consider power and status issues in the study of social contexts where participants occupy various roles and interact variously with individuals who occupy specific roles. Sociopolitical and sociocultural issues also influence how participants interact in various learning contexts (Bailey, 1969; Senge 1990).

Krippendorff's (1994) second-order cybernetic-based communication theory, in particular, provides an innovative approach for studying human communications embedded in values, beliefs, and communication styles that are developed by groups of people. Krippendorff's theory begins with the assumption that what is communicated depends on what the receiver understands to be communicated. This is a receiver model of communication. Communication conveyed through words, pictures, gestures, or touch are constituted by the receiver based on what lies in the receiver's understanding:

> Human communication constitutes itself in the recursive unfolding of communication constructions, held by participants (including communication constructions of each other), into intervening practices that these participants can recognize and explain in terms of being in communication. (p. 85)

Krippendorff's (1994) theory relies on a flexible systemic approach to content analysis that requires that possible influences in data analysis be made explicit (i.e., researcher role, measuring procedures, researcher-participant interaction effects, etc.). Data such as interpersonal communications are often complex, context-dependent, and require repeated analysis in order to achieve understanding. Content analysis techniques are important because they can be applied to many communication contexts unobtrusively and can accommodate unstructured material. Content analysis is also context-sensitive and can cope with large volumes of data (Krippendorff, 1980). Krippendorff's content analysis follows a set of scientific procedures that include sampling, theorizing, model-building, hypothesis-testing, and interpretation of results. His approach to content analysis is distinguishable from other forms of scientific inquiry as his form of scientific research is recursively embedded in the social processes it attempts to describe (see Figure 1).

Krippendorff's second-order cybernetic theory and approach to content analysis could contribute a great deal to the construction of a more comprehensive research methodology for studying computer-mediated learning communities. First, it is well suited for inquiry into the complexity of message systems found in computer-mediated learning communities and can analyze messages with multiple levels of meaning and can analyze messages that mean different things to different publics. The inclusion of unknown variations (perturbations) that are not part of the operational language allows for nonviable theories to be identified and ensures that the scientific procedure remains open to alternative theories

Figure 1. Network of scientific procedures (Krippendorff, 1991, p. 123).

or discourses that may influence scientific inquiry. Data variations that enter as perturbations allow theories to be challenged and theory construction to occur.

The major limiting factor of Krippendorff's (1994) second-order cybernetic theory and approach to content analysis is the absence of any reference to specific dimensions of variables that affect communication systems. Usage of perturbations and social concerns lack the specificity required for studying communication system influences in computer-mediated learning communities.

Summary. Second-order cybernetics and language pragmatics are discussed in reference to computer-mediated learning community research methodology. Researchers suggest that conversation taxonomies could enhance computer-mediated learning community research by providing a reliable means of studying higher-order learning processes that most quantitative content analysis did not offer. They also found that second-order cybernetic theory offers a more encompassing theoretical framework for addressing influences that may affect computer-mediated learning communities, but not without limitations.

Conversation System Model (CSM)

A conversational system model (CSM), which combines elements from second-order cybernetic epistemology and conversation analysis, construes learning communities as conversation systems that depend on multiple system influences. CSM is divided into individual, social, and political dimensions that address various questions: How do individuals engage in conversations (individual dimension)? How do communities pursue conversations (social dimension)? and How do sociopolitical conventions influence individual and social conversations (sociopolitical dimension)? This is represented visually in CMC as illustrated in Figure 2.

Conversational system modeling is a systemic approach to content analysis in text-based on-line communications. It attempts to combine conversation analysis methods with flexible second-order cybernetic theory to guide research in computer-mediated communities of learners. CSM makes the following assumptions:

1. *Conversation orientation*. Conversation acts are not isolated events, but rather a coordinated sequence of acts that are part of larger conversations (Winograd, 1988). The interpretation of utterance purpose by a speaker and hearer depends on the backgrounds of speaker and hearer (Searle, 1983) along with other cultural, political, or environmental factors.
2. *Control orientation*. Examining how utterances are controlled through conversational conventions is basic to CSM. For example, conversa-

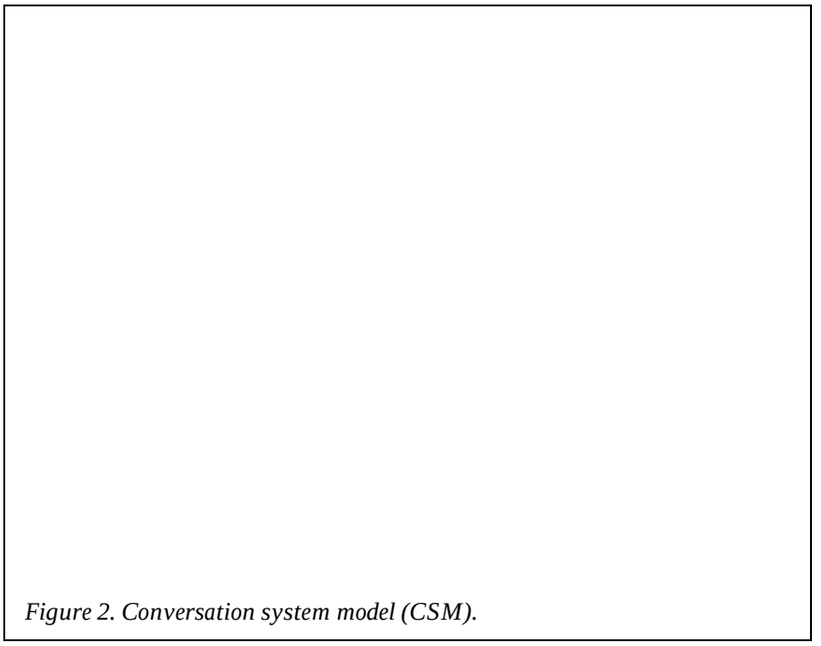

Figure 2. Conversation system model (CSM).

tion loci (i.e., first person, first person plural, second person, second person plural, or third person focus) provide information about perspective multiplicity (multiple perspectives). Analysis of conversational loci in conference transcripts can provide insight into issues of power, conflict, and conversational complexity (see Table 1).

3. *Social system orientation*. Analysis of normative and pragmatic rules embedded in sociopolitical and sociocultural structures (i.e., rituals, ideology, contests, conflicts, economic factors, environmental factors) contributes to the quality and meaningfulness of meaningful research interpretation.

Individual and Social Conversations

Individual and social conversation dimensions in CSM are attributed fundamental characteristics. First, conversation acts are expressed by a speaker to an external listener / reader (social conversation), or a listener / reader can be internal to the individual (individual conversation). This parallels Pask (1975), who construes individual conversationalists as capable of multiple simultaneous conversations both within and between individual conversationalists. Second, conversation analysis allows research inferences to be drawn from conversational content to the context and tested.

Table 1
Template for Conversation Analysis

Category	*Indicators*	*Definition*	*Example*
Speech Acts	Assertion	Commit the speaker to something being the case (Assertive)	e.g., I believe it is hot today
	Promise	Commit the speaker to some future action (Commissive)	e.g., I promise to correct my mistakes
	Question or Command	Attempt to get the hearer to do something or respond (Directive)	e.g., Do you know another way? Please go to the penalty box
Locus of Conversation	3rd person	Refer to another	e.g., Frank said
	2nd person	Refer to listener/reader	e.g., You are wrong
	1st person	Refer to speaker/author	e.g., I am right
	1st person plural	Refer to one's group	e.g., We will win

*Speech Acts adopted from Searle (1969).

Sociopolitical and Sociocultural Presence

Sociopolitical presence concerns normative and pragmatic rules in sociopolitical structures. Normative rules say what is the right and proper thing to do, whereas pragmatic rules indicate the effective thing to do. The notion of sociopolitical presence is based on the assumption that there are political structures, contests, conflicts, environmental factors, and change at the base of any society. "Beneath the contextual variations and cultural differences, political behavior reveals structural regularities" (Bailey, 1969, p. ix). Bailey's *Stratagems and Spoils* is a social anthropology of politics that examines political systems and how they operate. It argues that rule structures about how people should interact with one another as political individuals are interconnected with human interaction. Sociopolitical analysis is a research tool for studying normative and pragmatic rules in organizations and other social structures. For example, Luppicini (2002) employs a sociopolitical analysis as one research tool to contextualize a graduate students' association communication system within the larger university sociopolitical structure. Sociopolitical analysis of administrative, faculty, and graduate association political structures is coded into categories adopted from Bailey. This is illustrated in Table 2.

Sociocultural analysis describes an inquiry into values, beliefs, and communication styles developed by a group of people in a particular human environment. Sociopolitical and sociocultural presence is gradually growing in recognition as an important aspect of computer-mediated learner

Table 2
Sociopolitical Analysis of the Graduate Students' Association Communication System

Categories	*Administration*	*Faculty*	*Graduate Student Associations*
Prizes and values	University success reputation	Faculty success, department/program success, resources, reputation	Human rights resources
Personnel	Vice-rectors, secretaries, service people, tech support.	Faculty, TAs, secretaries, tech support	Secretary, house monitors, appointed students
Leadership/ team	Rector's cabinet Provost, Rector	Faculty Deans Department Chairs	Executive Board of Directors
Competition	Other universities	Other faculties	Accredited faculty associations
Control	University funding Representational appointments High power	Faculty funding from university and outside grants Representational appointments Medium power	Representational appointments, student association fees, resources Low power

communities. Kling and Scacchi (1982) assert that the implementation design is part of a larger web of issues that include economic, political, and social considerations. Winograd (1988) also emphasizes the limitations of computer-supported collaborative work and the need for researchers and developers to address issues such as the distribution of authority and strategies for conflict resolution. This line of reasoning advocates the need for research design to address a larger scope of issues that can greatly influence research outcomes.

CSM assumes that conversations are embedded in a complex conversational system where other influences are present. This becomes obvious where multiple individual conversations from the same person are recreated in various social conversations with various results. Individuals may engage in quite different conversations depending on the sociopolitical and sociocultural context.

CSM could be applied to Web-based documents and CMC conference transcripts as a methodological tool to advance educational research on computer-mediated learning communities that focus on complex learning and conversational processes. Good examples of research that could benefit from CSM are Jarvela and Hakkinen (2000) and Gilbert and Dris-

coll (2002). Jarvela and Hakkinen's inquiry into perspective-taking skills and reciprocal understanding among preservice teachers in Finland and the US and Gilbert and Driscoll's inquiry into graduate collaborative knowledge building and multiple perspectives are areas where CSM or similar approaches could contribute insight.

Limitations

It is too early to draw conclusions as to whether the Conversational System Model (CSM) or a similar approach will contribute to the quality of computer-mediated communications (CMC) learning environments. First, practical considerations such as limited time and resources for in-depth research, as well as marketplace demands for quick delivery of CMC design prototypes, could limit the usefulness of this type of research approach. Second, the theoretical grounding for the research draws from philosophy of language and communication theories, which requires that educational technologists invest effort to acquire knowledge bases outside the educational technology literature to apply in the field. Third, not all uses of CMC require conversational system modeling of a learning community. Many conversations occur mainly for the acquisition of or relaying of information via face-to-face, writing, radio, television, CMC, and so forth. Conversation system modeling is limited to CMC learning conversations with multiple levels of feedback mechanisms that integrate internal and social conversations, as well as conversational influences.

Conclusion

Discussion findings suggest that adopting conversation taxonomies could enhance computer-mediated learning community research by providing a reliable means of studying higher-order learning processes that most quantitative content analysis does not offer. In addition, second-order cybernetics offers a more encompassing theoretical framework for addressing the social, political, and cultural influences that may affect computer-mediated learning communities. Drawing together insights from conversational analysis and second-order cybernetics, the Conversational System Modeling (CSM) approach was posited as a viable means of improving research reliability and promoting broader encompassing research on computer-mediated learning communities.

Future research will apply CMC to explore conditions that affect discourse between individuals from various sociopolitical, sociocultural backgrounds and to identify barriers that can constrain interactions between diverse individuals who participate in computer-mediated learning communities. Jonassen (1995) agues that CMC learning communities must adopt tools that promote discourse among participants and open access to information. Gilbert and Driscoll (2002) suggested that ingrained beliefs

and existing paradigm structures based on traditional instructional models result in a continual struggle on the part of the student to engage in meaningful collaborative knowledge-building activities and perspective-sharing. This article represents a step toward providing a research methodology for studying the learning processes and broader sociopolitical influences that affect computer-mediated learning communities.

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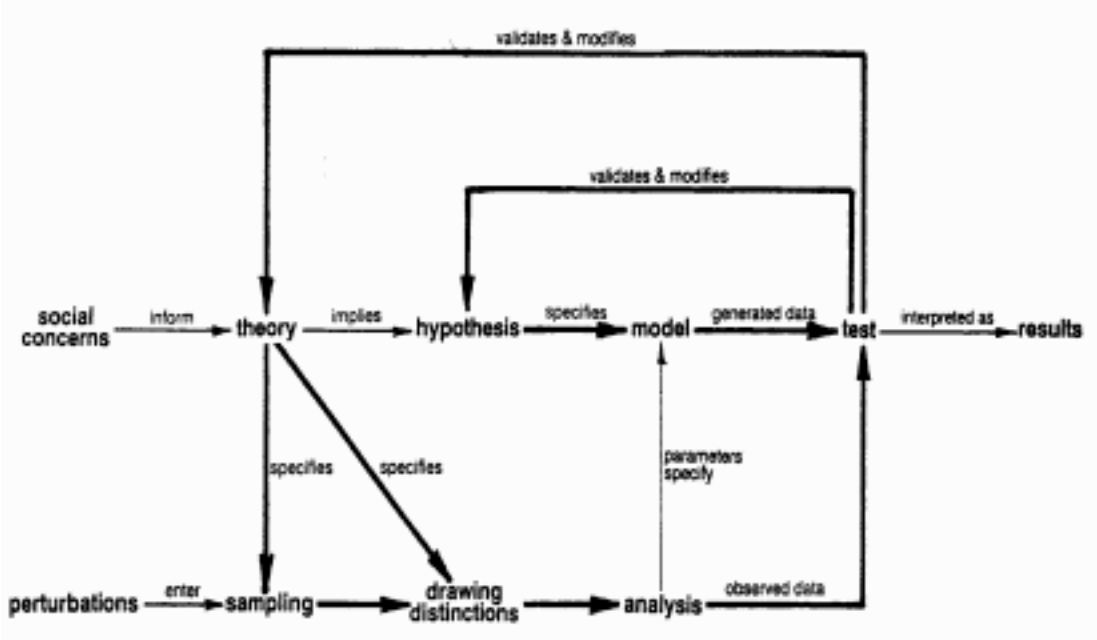

Figure 1. Network of scientific procedures (Krippendorff, 1991, p. 123).

Figure 2. Conversation system model (CSM).