COMPUTER-MEDIATED COMMUNICATION: PRACTICE, PROJECTS AND PURPOSES

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Abstract

This paper reviews the field of computer-mediated communication (CMC) with a focus on work in instructional settings. Studies from native English speaker and non-native English speaker contexts are considered with attention given to work in Asia, and specifically Singapore. It is hoped that the review will provide an overview of existing studies in the field and offer a framework within which the dynamics of CMC can be better understood, with pedagogical implications for classroom practitioners to consider.

1. Introduction

This paper reviews the field of computer-mediated communication (CMC) with specific attention given to work in instructional settings. The range of studies from a broad spectrum of different perspectives essentially comprises three categories: participation behaviour, discourse-based studies and educational CMC in instructional settings. Native English speaker, first language contexts as well as non-native, ESL or EFL contexts are considered in the review. It is hoped that the review will provide an overview of existing studies in the field and offer a framework within which the dynamics of CMC can be better understood with practical considerations for the language teacher.

1.1 Computer-mediated communication

CMC can be broadly defined as "human communication via computer" (Higgins, 1991). It involves interaction between humans using computers to connect to each other and generally refers to "any communication pattern mediated through the computer" (Metz, 1994: 32). What is significant is that the communication takes place "*through* a computer between human beings, instead of *to* an already determined computer system" (Ferrara et al, 1991: 31). Today, the technology for CMC has advanced to incorporating aural and visual input into text. In this paper, studies on text-only asynchronous CMC will be reviewed.

CMC was originally, in the 1960s, associated with communication in the defence and academic domains for military research purposes (Hiltz and Turoff, 1993). Over time, technological advancement enabled greater and more extensive use of CMC for commercial purposes, and encouraged the exponential spread and development of commercial networking on the global Internet scenario. Electronic mail (email) is recognized as the most popular application of CMC where it is more widely used than other services of the Net (Anderson, 1987; Blackwell, 1987;

Weisband, 1987). Today, a total of 498 million people have Internet access from home (Nielsen NetRatings, 2002).

2. Review of previous research in the field

CMC research, as stated earlier, could be broadly classified into three areas. The first involves participation issues, namely, aspects of student participation or non- participation, attitudes and participation styles of students and teachers. The second area comprises discourse-based studies which determine characteristic linguistic features representing the discourse generated. The studies also extend to examining structural features and patterns of discourse organisation. The third area focuses on educational CMC in instructional settings through information communication technology (ICT)-based projects with a focus on teaching and learning concerns including curricular matters and overall effectiveness for educational purposes (Romiszowski and Mason, 1996). Each area identified will now be considered in the following sections.

2.1 Participation-centred studies

Research on the social dynamics of computer use have essentially focused on participation concerns in terms of who communicates with whom and how much in CMC. The interest has basically centred on the following areas: the degree of participation in computer-mediated interaction compared to classrooms, and the extent of democracy and equality in CMC participation (McConnell, 1988; Chun, 1994).

Earlier studies on the degree of participation among students and instructors in CMC set-ups showed a democratic representation of participation (McConnell, 1988) with equal opportunity for participants to express their opinions that would have been impossible in face-to-face sessions, and an even higher percentage of student-student compared to student-teacher interaction (Chun, 1994) due to the "emancipatory medium" (McConnell, 1988: 160) of computer conferencing. Students' improved writing in computer-networked classrooms was a contrast to traditional classroom work, confirming findings from earlier studies (Hartman et al, 1991; Mabrito, 1991: 1992) where electronic discussions resulted in qualitative improvement in writing. The potential for deeper, more thoughtful classroom interaction is increased as participants reflect on or look up information before responding (Romiszowski and de Haas, 1989). In addition, discussion transcripts offer a permanent writing record which is not possible in oral discussion. Studies in the social psychological domain of CMC have, on the whole, shown the impact of group communication dynamics on the learning process in promoting democratic participation, and in enhancing the social presence and level of awareness of other participants.

CMC studies on participation behaviour generally showed a higher degree of participation with equal opportunities provided for the expression of opinions. Student participation, specifically among otherwise passive and reticent students, was greater in CMC than oral discussions. There

was more openness in electronic discussions compared to face-to-face interaction, with electronic discussions seen as a highly participatory and democratic medium of communication "equalizing" participation. This may be due to CMC being perceived as less threatening than face-to-face interaction, thus encouraging risk-taking and a more adventurous spirit in language use (Kern, 1995; Kelm, 1995; Warschauer, 1996). According to Sproull and Kiesler (1991: 48-49),

> People interacting on a computer are isolated from social cues and feel safe from surveillance and criticism. This feeling of privacy makes them feel less inhibited with others. It also makes it easy for them to disagree with, confront, or take exception to others' opinions.

However, participation-type studies in CMC focus largely on the quantification of the frequency of participation and/or the length and number of turn-taking without adequately taking into account the complexities and intricacies associated with the dynamics of an evolving form of multi-party communication. Further, it is not tenable to suggest that learning benefits to participants could be assessed through statistical measures of participation rates and the frequency of individual contributions alone. The specific effects of the computer medium on the dialoguing process of participants in an online environment have not been as extensively and systematically researched. Further research into this would prove enlightening where the dynamics of participant interaction through the computer messaging system are concerned, and may offer insights for the effective management and control of learning through computer-mediated interactions.

2.2 Discourse-centred studies

Studies in CMC discourse are generally aimed at determining the nature of discourse generated, namely, how the discourse differs from other types (oral and/or written) and the extent to which written or spoken English features are evident. Discourse focus in CMC also allows for examining the structuring of computer-mediated messages. Attention is given to sequential

organisation of messages in an online environment. The resulting "style" which characterises the discourse is also of interest in this area.

2.2.1 Linguistic features of computer-mediated discourse

Studies on the nature of electronic discourse involve both L1 (Murray, 1985, 1988, 1991; Ferrara et al, 1991; Collot and Bellmore, 1993; Davis and Brewer, 1997; Slaouti, 1998; Gruber, 2000; Matthews, 2000) and L2 contexts (Kern, 1993; Chun, 1994; Kitade, 2000). Murray's (1985, 1988, 1991) work showed computer "conversation" discourse to be interactive, displaying both oral and written discourse features. The former is characterised by "active voice and personal pronouns; emotive and informal diction; hedging and vagueness; paralinguistic cues; and direct quotations" (Murray, 1985: 217) and forms of fragmentation, in particular, ellipsis and contractions. The latter comprised more formal pronoun use, highly technical language and definiteness (Murray, 1991a:36), and integration through "nominalisation and attributive adjectives; participles and complement and relative clauses" (Murray, 1985: 220). Computer conversation did not have "a static place on the oral/written continuum" but rather moved "back and forth between writer-style and talker-style, as interactants change voice" (ibid: 224).

The notion of an "emergent" form of discourse is further reinforced in studies (Davis and Brewer, 1997; Slaouti, 1998; Gruber, 2000) of students' electronic discussions where texts feature a combination of written and oral features, reflective of a "writing talking" (ibid: 165) type with "hybrid" characteristics of the two modes. Finer interaction type distinctions surfaced in studies (Matthews, 2000) which showed general discussions with more transactional dialogue and abstract-centred ones having more interactional dialogue.

The studies examined are generally agreed upon the "hybrid" nature of electronic discourse with both oral and written discourse features, and varying degrees of detailed specification with regard to specific features. The discourse is termed "interactive" or "emergent" where features do not remain fixed but vary according to functions in contexts where they occur. The approach remains very much at the level of classifying features into one mode of discourse or another, or quantitative in statistically tabulating and cataloguing lists of features identified. The specifics of how discourse features and linguistic devices function to fulfil particular roles within specific

contexts in the dynamic, interactive environment of online communication, however, do not appear to have received comparable attention.

2.2.2 Structural features and sequential organization of discourse

Interest in the spoken-written discourse relation has also extended to examining sequential structures of electronic messages in the form of comparative studies (Black et al, 1983; Severinson, 1986) of computer-mediated communication with oral discourse. Black et al's (1983) study indicated that strict sequentiality was not universal. In computer-mediated discussions, several topics were simultaneously pursued through "multiple threads of discourse" rather than one at a time in face-to-face interactions. Secondly, the sequential organization was a simplified two-part Initiation-Reply instead of a three-part Initiation-Reply-Feedback structure (Sinclair and Coulthard, 1975). Thirdly, a longer lag time between Initiation-Reply components was evident compared to face-to-face interactions. These findings were also reinforced in Severinson's (1986) study which revealed the simultaneous management of several topics, a prototypical two-part question-answer exchange instead of three-part and the absence of independent feedback moves.

Severinson's empirical study, like Black et al's (1983), however, did not allow for various initiation types, and topic maintenance and development to be further pursued. Investigation into these issues would fill the gap in an area critical to an understanding of effective electronic dialoguing. While the selected comparative studies suggest that electronic communication differs linguistically from traditional written and spoken discourse, there is still room for further research to identify specific discourse features and linguistic devices which impact on participant interaction, and which account for the specifics of multiple threading of discourse that enable the online construction of coherent "conversation" in a discussion forum.

Discourse-centred studies have identified specific linguistic features characterising electronic discourse as recognisable text types which may share similarities or differences with oral and/or written modes of discourse. The terms "spoken" and "written" have been replaced with other terms for the ends of the discourse spectrum, such as "interactive versus edited text" (Biber, 1986: 395) or "spontaneous" versus "self-monitored" discourse (Halliday, 1978: 69). Computer-mediated discourse is also usually placed at the oral end of the continuum (Schafer, 1981; Scribner and Cole, 1981; Chafe, 1985).

Studies of CMC discourse have, for the most part, seen more quantitative measures (number of participants, number of messages, number and length of conferences, etc). The volume of messages is taken as an implicit measure of the efficiency and effectiveness of online exchange. Participation is measured by the number of messages transmitted, the number of server accesses, the duration of consultations and even the number of lines of text transmitted (Hiltz, 1986). These need to be balanced with a focus on discourse features and strategic linguistic devices in relation to the nature of interactivity and electronic development of topics across messages.

One such attempt is Ho's (2002) study of asynchronous communication in an electronic discussion forum, largely influenced by conversational and discourse analyses, and multi-party online communication. The analysis of the nature and structuring of discourse determines how messages are recognised linguistically to fulfil specific functional roles in the forum. Emphasis is placed on the mechanisms underlying the dynamics of participant interaction and the extent to which participants constitute an identifiable discourse community which regulates and helps to establish conventions in the forum. Except for Ho (2002), there remains a dearth of local in-depth studies which relate the examination of specific discourse features and linguistic strategies to the construction of interaction and topic within a community with a recognisable identity.

2.3 Education-centred studies

Studies on CMC in instructional settings are usually project-based, involving online collaborative exchange using computer networks. These are commonly observed in the language arts for local and global linking of classrooms, group problem-solving at the primary and secondary levels, and as a means of group interaction in distance and higher education (Higgins, 1991). The asynchronicity of CMC and its independence of place supporting participants anywhere in the world have made it notably advantageous as a form of communication in educational delivery and interaction promoting collaborative learning among participants (Turoff, 1990: ix).

Online projects of ESL university students in international, cross-cultural collaboration (Tella, 1991 and 1992; Bellman et al, 1993; Vilmi, 1994; Shamoon, 1998; Yu and Yu, 2002) generally yield positive language learning results. The BESTNET project indicated that students' anonymous identities were a "valuable pedagogical resource for initiating the discussion, and in sustaining and promoting the strong assertive remarks" (Bellman et al, 1993: 241). Other benefits (ibid: 241-242) ranged from facilitating off-campus or distance education to promoting active

learning and participation among learners, and encouraging overall gains in literacy and critical thinking development. Similar positive results were noted in other studies: greater student collaboration, authenticity and high motivation in technical writing as well as increased enthusiasm, increased and improved writing quality through peer feedback and reflection (Vilmi, 1994; Shamoon,1998; Yu and Yu, 2002).

University-level CMC projects have generally supplemented existing modes of instruction, and extended students' learning tasks and activities at various levels. The learning process is enhanced through what is seen as a novel approach which develops communication skills and provides exposure to resources and global viewpoints through active collaboration. Students' engagement with each other enables the cultural aspects of target languages to be learnt in a more dynamic way than if teachers only were to provide the input. In schools, CMC is seen as a means of "extending the boundaries of an environment, regardless of actual physical location" (Tille and Hall, 1998:118), and encouraging information gathering from local and global sources (Brush, 1998; Tille and Hall, 1998; Grimes and Owens, 1998; Shulman, 2001). Brush's (1998) novice-expert computer networking among elementary students and senior citizens facilitated the electronic sharing of information and a wide range of perspectives and viewpoints regarding historical, social and political issues. Tille and Hall's (1998) project of students' online interviews and correspondence revealed CMC as a useful tool which "enhances the writing process, augments collaboration, develops new and valuable communication skills, and provides exposure to new resources and global viewpoints" (Berge and Collins, 1998: 10). Grimes and Owens' (1998) study of students' email involved an information exchange and research-correspondence which provided students a "challenging and rejuvenating learning experience" (ibid: 127) for both students and teachers with quantitative and qualitative improvements from increased message length to students' overall positive attitude and enthusiasm. Collaborative, cross-cultural Internet projects (Shulman,

2001) integrated classroom learning with online experiences and enhanced students' reading and writing skills, expanding their cross-cultural skills and sharpening their technological abilities. The collaboration resulted in positive benefits which included a review of traditional classroom practices, development of alternative styles of learning, accelerated learning of reading and writing skills, greater student participation and the building of a community of learners where students feel they are "part of a social process rather than learning in isolation" (ibid: paragraph 13).

The overall "empowerment and emancipation effects" (Higgins, 1991) of CMC is widely acknowledged in the educational context, given its accessibility, economical and inexpensive use relative to other technologies (Turoff, 1990: ix). Students learn to negotiate ideas about what is learnt among themselves and to collaboratively construct new knowledge. This leads to positive results in language learning, ranging from improved writing skills; overall positive attitude and enthusiasm towards the use of the computer for communication; to personal gains through a more diverse outlook and perspective, and finally to heightened cross-cultural self-awareness.

While these are overall positive gains, education-centred studies remain essentially project reports detailing concrete and observable instructional objectives realised in terms of specific learning outcomes and the stages of implementation to achieve those goals. The nature of CMC use in the classroom context is very much informed and directed by the goals set out in these projects. While these project-based studies may serve specific educational learning goals for which the projects are planned, they are not, in themselves, research studies grounded in systematic, rigorous inquiry aimed at developing discourse-based models of investigation on specific aspects of CMC. Neither does the use of CMC in such contexts represent the use of

technology in generating a spontaneous and naturally-occurring form of discourse in an informal context. The studies remain within the confines of a purely educational setting, framed by pre-determined instructional concerns.

There is room for further research in examining CMC guided by specific theoretical constructs and underlying principles to facilitate a more informed approach to investigating naturally-occurring computer-mediated interaction. According to Harasim (1989: 50), adhering strictly to the traditional perspective of CMC in the educational context, namely as "a variant of distance education or as an extension of classroom activities", may lead to a limited understanding and appreciation of the "full potential of this new medium".

Further, it has been noted that while positive language learning generally results in the technology-enhanced classroom, it is the "communicative facilities of the Net rather than the resources offered" (Ho, 1997: 24) that are actively tapped by teachers and students. It is thus reasonable to assume that given the implementation of CMC in the classroom, the value of computer-mediated networking must extend beyond mere information dissemination to the integration of response to opinions and reactive feedback given, and the construction and management of diverse opinions and perspectives in online discussions. This is an area worth looking into which has not been given comparable attention in the field.

2.4 Singapore-based research

Studies in Singapore can be broadly categorised into two main groups, namely educational application as in students' computer networking through cross-cultural, international projects, and the study of language use through computer-mediated discussions, including Internet newsgroups or Internet Relay Chat (IRC). A third more recent area involves the use of different forms of technology in CMC for online discussions.

The first category of studies (Soh and Soon, 1991; Ho, 2000) which focuses on the computer as a communicative and learning tool yielded generally positive benefits for students, namely, in communication skills and personal enrichment of their lives through heightened cultural awareness. The second set of studies (Tan, 1995; Foo, 1996; Tse, 1999) focusing on the type of language resulting from the specific form of CMC used, revealed insights into students' cultural and national identity, and the extent to which the variety of English used characterises CMC.

Tan's (1995) investigation of language use in an Internet Relay Chat (IRC) programme focused on the "country-specific" and "non-country specific" channels; the latter further categorised between topic-focused and non-topic focused channels. English was regarded as having greater "international utility" as a lingua franca compared to other languages used in IRC for communicating across national or ethnic groups. Foo's (1996) study of Singaporean Internet participants in an Internet newsgroup "soc.culture.singapore" showed the development of "Internet English", with a distinct set of lexis and syntactic structures and Singaporeans' adaptability in their ability to merge both types of discourses together.

A third area of growing research interest focuses on online discussions using various forms of technology recently introduced in Singapore (Lim et al, 2002). Lim et al (ibid) examined the use of Wireless Application Protocol (WAP), General Packet Radio Service (GPRS) and 3G (Third Generation) technologies in supporting electronic discussions in learning communities. These different forms of technology are additional tools that allow students and tutors access to the Internet, anywhere and anytime, via the micro browser-equipped wireless phone. The project explored their opportunities and limitations through a classroom case study with implementation concerns and benefits to students dominating the focus.

The available Singapore-based studies have been primarily concerned with collaborative computer-networking of students with their overseas peers. These have led to general improvements in students' command of English, and their personal development and awareness of themselves as members of a global community. The remaining isolated studies on newsgroups and the Internet Relay Chat mainly by students and undergraduates have attempted to characterise the type of English used by Singaporean participants through which a distinctive identity among participants is evident. However, the data size of these studies is often too limited to enable conclusive generalisations to be made. Recent attempts at examining different forms of technology focused on issues relating to implementation concerns and general positive gains to students.

3. Implications

Product-focused versus process-centred

There is an overemphasis in projects on the final products generated from CMC tasks/activities involving participants in various settings and contexts. This needs to be balanced against attention to the processes involved, namely, with regard to the nature of interactivity and the dynamics involved in participating in an online environment. To what extent are participants involved in CMC adequately equipped with the necessary skills and knowledge to be able to engage effectively in interacting in a medium which is unlike a traditionally oral and/or written mode?

Personal recounts versus objective analyses

Many CMC studies feature participants' narrating their personal experiences or specific encounters within particular contexts. There is a detailing of procedural steps involved and highlighting of problems faced without necessarily considering the possible outcomes or recommendations which can be generalized and applied to wider contexts Often, investigators' reported case studies of their experiences with and observations of those involved are emphasized over empirical research involving detailed transcript analysis and processing of textual data which would offer useful insights to both researchers and practitioners alike.

Quantitative versus qualitative aspects of computer-mediated communication

Statistical, quantitative data analyses drawn from CMC projects involve enumerating or quantifying the number (frequency) and duration of specific aspects of interaction in computer-mediated environments. The concern is with how much or how often as opposed to how well or fully developed, expressed or adequate are participants engaged in the interaction. Specific discourse features, central linguistic resources and adaptive participant strategies which characterise the interactivity of computer-mediated discussion are not given as much attention.

Optional extra versus optimal integration

CMC studies may come across as a supplement to teaching where they are realised as additional tasks or optional extras rather than as well-integrated practices which have been fully infused into the curriculum with specific learning outcomes made clear to both teachers and students. The danger is to see these computer-mediated tasks and activities as supplements remaining on the periphery of classroom practice, or worse, as "showy" presentations or school projects, and not practices worthy of study and implementation in their own right.

4. Conclusion

The studies reviewed provide a background framework with which to understand the number of earlier studies as well as ongoing growing interest and developments in CMC. Substantial proportion of studies, however, are noted to explore the potential of CMC for educational purposes in the form of investigators' case studies rather than empirical research involving detailed analysis and processes involved in participant interaction. There is still room within the area of content analysis to examine specific discourse features and strategies drawn from electronic messages generated through CMC in relation to the process of interactivity and the dynamics involved in a community of online participants.

Findings from most of the studies in CMC can be broadly categorised into the following main areas: democratic student participation with more participation from otherwise passive or reticent students; and positive effects including heightened cross-cultural awareness, gains in general language learning and the affective domain with an overall positive attitude towards computer use for communication. Previous studies of CMC have also focused on psychological factors affecting attitude and participation or on the perceived attributes of the medium, often using small and specific data sets. There is considerable room for further research as a large number of earlier studies have not been widely extensive.

Existing studies generally point to the linguistic differences of electronic discourse from both traditional written and oral discourse. What is less evident are participants' specific strategies as they engage in interaction, given the demands placed on them through CMC. Specific discourse features, central linguistic resources and adaptive participant strategies which characterise the interactivity of computer-mediated discussion have yet to be adequately examined. According to Kelm (1992: 445), the "interactive quality" of discourse frequently associated with this form of communication has been likened to real conversation, but generally along what has been recognised to be impressionistic lines. Further, as Ortega (1997: 87) noted, "the discoursal status of language produced in electronic interactions seem(ed) difficult to determine", and appears not to have been given comparable attention as project-based studies.

The general picture which emerges is that until now studies involving CMC have been approached from largely the educational context through projects at both school and university levels; and taken the form of discourse-based studies primarily aimed at highlighting similarities and differences in oral and/or written language, and participation-centred studies using largely quantitative measures of participation. A large number of studies have been anecdotal or isolated projects directed by specific educational outcomes which largely determine their implementation and focus on a tangible, concrete product. These studies are not necessarily influenced by methods of inquiry with the potential of developing an integrated approach to examining discourse which is naturally occurring, organic and dynamic in its nature and development. As electronic discourse differs from print texts, the approach taken, whether in research or classroom implementation, needs to give due consideration to the electronic communication generated and the community which supports its practice as discourse unique in themselves. A need remains to re-focus text-based asynchronous communication as extended stretches of

discourse which cohere, and contribute to meaningful and coherent discourse, and which characterise individual participants as members of a distinct community.

References

Anderson, P. (1987) “Faculty and student observations of their computing behaviour.” In Kiesler, S., Sproull, L. (eds*.) Computing and change on campus*. Cambridge: Cambridge University Press., 90-100.

Bellman, B., Tindimubona, A., Arias Jr. (1993) “Technology transfer in global networking: Capacity building in Africa and Latin America.” In Harasim, L. M. (ed.) 1993. *Global networks: Computers and international communication*. Cambridge, Mass.: MIT Press, 237-254.

Berge, Z.L.; Collins, M. (1998). *Wired together: The online classroom in K-12*. Vol. 2: Case Studies. Cresskill, NJ: Hampton Press, Inc.

Biber, D. (1986). "Spoken and written textual dimensions in English: Resolving the contradictory findings." *Language, 62*, 384-414.

Black, S.D.; Levin, J.A.; Mehan, H. and Quinn C.N. (1983). "Real education in non-real time: The use of electronic message systems for instruction." *Instructional Science, 11*, 313-327.

Blackwell, M. (1987) “Electronic observations of computer user behaviour.” In Kiesler, S.; Sproull, L. (eds.) 1987. *Computing and change on campus*. Cambridge: Cambridge University Press., 70-89.

Brush, T. (1998). In Berge, Z.L.; Collins, M. *Wired together: The online classroom in K-12. Vol. 4: Writing, reading and language acquisition*. Cresskill, NJ: Hampton Press, Inc, 101-109.

Chafe, W.L. (1985). "Linguistic differences produced by differences between speaking and writing." In Olsen, D.; Torrance, N.; Hildyard, A. (eds.) *Literacy, language and learning: The nature and consequences of reading and writing*. New York: Cambridge University Press, 105-123.

Chun, D. (1994) “Using computer networking to facilitate the acquisition of interactive competence.” *System*, 22, 17-31.

Collot, M., Belmore, N. (1993) “Electronic language: A new variety of English.” In Aarts, J.; de Haan, P.; Oostdijk, N. (eds.) *English language corpora: Design, analysis and exploitation.* Amsterdam-Atlanta, G.A.: Rodopi B.V., 41-55.

Davis, B.H., Brewer, J.P. (1997) *Electronic discourse: Linguistic individuals in virtual space.* Albany: State University of New York Press.

Ferrara, K., Brunner, H., Whittemore G. (1991) “Interactive written discourse as an emergent register.” *Written communication,* 8 (1), 8-34.

Foo, Q.A. (1996) “The language of the Internet in Singapore.” In Yong, L.L., Wong, L. (eds.) *Mindscapes, landscapes*. Singapore: Gifted Education Branch, Ministry of Education and Faculty of Arts and Social Sciences, National University of Singapore, 79-88

Grimes, P.R.; Owens, M. (1998). "Characters online: 4th and 12th graders’ exchange letters." In Berge, Z.L.; Collins, M. *Wired together: The online classroom in K-12. Vol. 4: Writing, reading and language acquisition*. Cresskill, NJ: Hampton Press, Inc, 127-136

Gruber, H. (2000) “Scholarly email discussion list postings: A single new genre of academic communication?” In Pemberton, L.; Shurrille, S. (eds.) *Words on the web: Computer-mediated communication.* Exeter: Intellect Ltd, 36-43.

Halliday, M.A.K. (1978). *Language as social semiotic: The social interpretation of language and meaning.* London: Edward Arnold Ltd.

Harasim, L. M. (1989). "On-line education: A new domain." In Mason, R. and Kaye, A. (eds.) 1989. *Mindweave: Communication, computers and distance education.* Oxford: Pergamon Press, 50-62.

Hartman, K., Neuwirth, C., Kiesler, S., Sproull, L., Cochran, C., Palmquist, M., Zubrow, D. (1991) “Patterns of social interaction and learning to write: Some effects of networked technologies.” *Written communication*, 8, 79-113.

Herring, S.C. (ed.) (1996a) *Computer-mediated communication: Linguistic, social and cross-cultural perspectives.* Amsterdam: John Benjamins Publishing Company.

Herring, S.C. (1996b) “Two variants of an electronic message schema.” In Herring, S.C. (ed.) *Computer-mediated communication: Linguistic, social and cross-cultural perspectives.* Amsterdam: John Benjamins Publishing Company, 81-106.

Higgins, R. (1991) *Computer-mediated cooperative learning: Synchronous and asynchronous communication between students learning nursing diagnosis.* Unpublished doctoral dissertation. University of Toronto. http://www.cybercorp.net/rhiggins/thesis/

Hiltz, S.R. (1986). *The virtual classroom: building the foundations*. Newark, NJ: New Jersey Institute of Technology.

Hiltz, S.R.; Turoff, M. (1978). *The network nation: Human communication via computer*. Cambridge, Mass.: MIT Press.

Ho, M.L.C. (1997) "The Internet and English Language teaching." *REACT*, June,1, 22-28.

Ho, M.L.C. (2000) "Developing intercultural awareness and writing skills through email exchange." *The Internet TESL Journal*, VI (12), December. http://www.aitech.ac.jp/~iteslj/Articles/Ho-Email.html

Ho, M.L.C (2002) *Online communication: A study of the construction of discourse and community in an electronic discussion forum*. Unpublished PhD thesis. Birmingham: University of Birmingham

Kelm, O. (1995) "Application of computer networking in foreign language education: Focusing on principles of second language acquisition." In Warschauer, M. (ed.) *Telecollaboration in foreign language learning: Proceedings of the Hawaii Symposium*. Honolulu, HI: University of Hawaii Second Language Teaching and Curriculum Centre, 19-29.

Kern, R. (1993) "*Restructuring classroom interaction with networked computers: Effects on quantity and quality of language production*." Paper presented at the meeting of American council of teachers of foreign languages, San Antonio, TX.

Kern, R. (1995) "Restructuring classroom interaction with networked computers: Effects on quantity and quality of language production." *Modern language journal*, 79 (4), 457-476.

Kitade, K. (2000) "L2 learners' discourse and SLA theories in CMC: Collaborative interaction in internet chat." *Computer-assisted language learning*, 13(2), 143-166.

Lim, C.P; Lee, C.B.; Tan, S.C., Seow, W.L., Yap, F.Y.; Cheah, H.M., Chang, K.W.; Chua, M.K. (2002). "Supporting E-discussions with new technologies (WAP, GPRS, 3G) in learning communities." Unpublished 3 January Final report on research project in collaboration

with Mobile One (Asia) Pte Ltd. National Institute of Education/Mobile One (Asia) Pte. Ltd.

Mabrito, M. (1991) "Electronic mail as a vehicle for peer response: Conversations of high- and low-apprehensive writers." *Written communication*, 8, 509-532.

Mabrito, M. (1992) "Computer-mediated communication and high-apprehensive writers: Rethinking the collaborative process." *The bulletin*, 26-30.

Matthews, H. (2000) "Effects of group identity on discussions in public on-line fora." In Pemberton, L.; Shurville, S. (eds.) *Words on the web: Computer mediated communication.* Exeter: Intellect Ltd, 79-86.

McConnell, D. (1988) "Group communications via computer conferencing-the educational potential." In Smith, D. (ed.) *New technologies and professional communications in education*. London: National Council for Educational Technology, 146-168.

Metz, J.M. (1994) "Computer-mediated communication: Literature review of a new context." *Interpersonal computing and technology: An electronic journal for the 21st century*, 2 (2), 31-49.

Murray, D.E. (1985) "Composition as conversation: The computer terminal as medium of communication." In Odell, L.; Goswami, D. (eds.) *Writing in nonacademic settings*. New York: Guilford, 203-227.

Murray, D.E. (1988a) "Computer-mediated communication: Implications for ESP." *English for specific purposes*, 7, 3-18.

Murray, D.E. (1988b) "The context of oral and written language: A framework for mode and medium switching." *Language in society*, 17, 351-373.

Murray, D.E. (1991a) "The composing process for computer conversation." *Written communication*, 8 (1), 35-55.

Murray, D.E. (1991b) *Conversation for action: The computer terminal as medium of communication.* Amsterdam/Philadelphia: John Benjamins Publishing Company.

Nielsen/Net Ratings Global Internet Trends Service. (2002) *Reports on Internet access and penetration*, 6 and 7 March, http://www.nielsen-netratings.com/

Romiszowski, A.J., de Haas, J.A. (1989) “Computer-mediated communication for instruction: Using e-mail as a seminar.” *Educational technology,* 29 (10), 7-14.

Romiszowski, A.J., Mason, R. (1996) “Computer-mediated communication.” In Jonassen, D. (ed.) 1996b. *Handbook of research for educational communications and technology.* New York: Simon and Schuster Macmillan, 438-456.

Severinson, E. K. (1986) *Dialogue processes in computer-mediated communication: A study of letters in the COM system.* Linkoping studies in arts and science, 6. Linkoping, Sweden: Linkoping University.

Schafer, J. (1981). "The linguistic analysis of spoken and written texts." In Kroll, B.; Vann, R. (eds.) *Exploring speaking-writing relationships: Connections and contrast.* Urbana, IL: National Council of Teachers of English, 1-31.

Scribner, S., Cole, M. (1981). *The psychology of literacy*. Cambridge, MA: Harvard University Press.

Shamoon, L. K. (1998) “International e-mail debate.” In Reiss, D. Selfe, D.; Young, A. (eds.) 1998. *Electronic communication across the curriculum.*Urbana, Illinois: National Council of Teachers of English, 151-161.

Shulman, M. (2001). "Developing global connections through computer-mediated communication." *The Internet TESL Journal,* VII (6), June.

http://iteslj.org/Articles/Shulman-CMC.html

Sinclair, J.M; Coulthard, R. M. (1975). *Towards an analysis of discourse*. London: Oxford University Press.

Slaouti, D. (1998) “Developing writing skills: a role for email.” Paper presented at 1998 BAAL Seminar, Manchester.

Soh, B.L., Soon, Y.P. (1991) “English by e-mail: Creating a global classroom via the medium of computer technology.” *ELT Journal,* 45 (4), 287-292.

Sproull, L., Kiesler, S. (1991) *Connections: New ways of working in the networked organisations*. Cambridge, Mass.: MIT Press.

Tan, B.H.E. (1995) "*English in cyberspace.*" Unpublished Academic Exercise. Singapore: Department of English Language and Literature, National University of Singapore.

Tella, S. (1991) "*Introducing international communication networks and electronic mail into foreign language classrooms.*" Research report no. 95. Helsinki: University of Helsinki, Department of Teacher Education.

Tella, S. (1992a) "*Boys, girls and email: A case study in Finnish senior secondary schools.*" Research report no. 110. Helsinki: University of. Helsinki, Department of Teacher Education.

Tella, S. (1992b) "*Talking shop via email: A thematic and linguistic analysis of electronic mail communication.*" Research report no. 99. Helsinki: University of. Helsinki, Department of Teacher Education.

Tille, M.; Hall, B. 1998. "Connecting to a meaningful life: A case study." In Berge, Z.L.; Collins, M. *Wired together: The online classroom in K-12. Vol. 4: Writing, reading and language acquisition*. Cresskill, NJ: Hampton Press, Inc, 111-126.

Tse, N. (1999) "*Wired differently: An investigation into gender styles in electronic mail*." Unpublished Academic Exercise. Singapore: Department of English Language and Literature, National University of Singapore.

Turoff, M. (1990) "Forward." In Harasim, L.M. (ed.) *Online education: Perspectives on a new environment.* New York: Praeger Publishers, ix-xiii.

Warschauer, M. (1996a) "Comparing face-to-face and electronic discussion in the second language classroom." *CALICO Journal,* 13 (2), 7-26.

Weisband, S. P. (1987) "Instrumental and symbolic aspects of an executive information system." In Kiesler, S.; Sproull, L. (eds.) *Computing and change on campus*. Cambridge: Cambridge University Press, 150-169.

Vilmi, R. (1994) "Global communication through email: An ongoing experiment at Helsinki University of Technology." Paper presented at EUROCALL conference, September 1994, http://www.hut.fi/~rvilmi/Publication/global.html

Yu, F-Y., Yu, H-J. (2002) “Incorporating e-mail into the learning process: its impact on student academic achievement and attitudes.” *Computers and education*, 38 (1-3). http://www.elsevier.nl/locate/jnlnr/00347