

Constraints on the use of computer-mediated communication to facilitate learning

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Abstract

In recent years computer-mediated communication (CMC) has become an international phenomenon and one which has enormous educational potential for students studying in a multi-modal, multi-campus environment. In particular, it has the potential for teachers and students to construct new ways of learning which are unique to the medium and consistent with constructivist perspectives on teaching and learning.

Yet this potential is often not realised because of the attitudinal, technological and institutional barriers which affect usage of the medium, and in particular, its pedagogical usage. Drawing on comparative case studies, this paper outlines the ways in which CMC has been used with various groups of graduate and postgraduate students, identifies some of the more common barriers which affect how it is used, and describes attempts being trialled to overcome them.

Introduction

Higher education in the 1990's has seen a move towards multi-modal, multi-campus delivery of courses. At the same time, developments in the field of computing and communications have resulted in a number of new technologies which have the potential to transform the nature of interactions in educational environments. One such technology is computer-mediated communication (CMC) which, in recent years, has become an international phenomenon that has significantly broadened educational opportunities. CMC is essentially a discursive medium because it involves bringing people together for discussion. It can be one-to-one or one-to-many as with traditional distance education, or it can be one-to-many or many-to many as with face-to-face tutorial situations.

This medium has the potential to enrich learning by complementing existing technologies and methods of teaching. The flexibility of educational offerings can be increased by blurring distinctions between traditional face-to-face and distance education delivery modes. In this environment there is potential for teachers to create a new educational paradigm through the development of innovative teaching ideas unique to the medium. Furthermore, it can enable students to construct new ways of learning and provide them with increased opportunities for interaction, a vital characteristic of the process of learning. Indeed, as Harasim (1990, p. xvii) claims, "online education offers unprecedented options for teaching, learning and knowledge building".

In some institutions, CMC is already forcing organisational change and affecting the ways in which people work within and across

organisations. For example, it is replacing many phone calls and meetings, and has reduced the use of conventional mail. However, as with any change in educational institutions, the potential that CMC offers for enhancing learning is not being fully realised because of the attitudinal, technological and institutional barriers which hinder its implementation.

This paper reports some preliminary findings from case studies being conducted to determine the factors which constrain effective use of the medium for learning purposes. At the most basic level, it can be assumed that the major constraining factor is access to the new technologies. For the purposes of this study, access to the medium is presupposed because of course, students cannot engage in online activities without it.

Review of the Literature on the use of CMC

The literature on CMC is burgeoning and has already shed much light on the effective use of the medium for pedagogical purposes. It is evident that CMC has been used in a wide range of subject areas and in a variety of institutional settings. Books and edited texts have been published which outline the potential of CMC and provide strategies for its use in education (Harasim, 1990, 1993; Kaye, 1992; Mason and Kaye, 1989). The extent of institutional interest and involvement in the use of CMC has been documented by Wells (1992) in a research monograph and numerous case studies have provided insights into what happens when CMC is incorporated into a course (See for example Cuskelly and Gregor, 1993; Eastmond, 1994; and those cited by Mason and Kaye, 1989; Harasim, 1990; Wells, 1992).

Unique features of computer-mediated communication

CMC can take many forms and serve many purposes, but in an educational environment, it is reasonable to assume that its primary use is to enhance learning. As a number of writers have argued persuasively, the advantages of using CMC in courses for educational purposes cannot be ignored (Harasim, 1990; Kaye, 1989) because it provides course design and pedagogical options that have not previously been available. For instance, it can overcome the major limitations of place-based education, time and space, and the individualism and isolation of distance education.

It provides opportunities for distance students to communicate regularly with lecturers, tutors and other students about all aspects of their student life, thereby reducing the sense of isolation often experienced when studying away from campus. They can interact with their peers both for social and learning purposes, they can work collaboratively in groups, and they have opportunities for receiving prompt and ongoing feedback on their work. Moreover, this can occur in a democratic, potentially empowering environment where all students have the opportunity to consider an issue fully before contributing to

the dialogue in some way, and where everyone can take a turn when it suits them . That is to say, there are no time and space constraints, because of its asynchronous nature. As Kaye (1989) has noted, the CMC environment can take account of and maximise students' states of readiness for learning. This is in marked contrast to traditional face-to-face or telephone contact where contributions to any discussion have to be made on the spot, because there are always time constraints and pressing issues relating to group dynamics.

In terms of the communication which occurs, Feenberg (1989) points out that it gives students practice at developing their writing skills, and has the potential to improve literacy which in turn will enhance success in assessment. Furthermore, there is always an accurate written record of any online discussion which is retrievable at any time, providing a strong basis for reflection on particular topics and issues. The possible range of inputs is immense because people from anywhere in the world can be brought online to contribute to a discussion. This broad resource of ideas can enhance student's construction of knowledge and lead to deeper understandings and shared meanings about particular concepts.

A further educational advantage discussed by Kaye (1989) is that the CMC environment is serendipitous because unexpected events and interactions can occur, which can add another dimension to the learning experience.

Research findings on the use of CMC

CMC has been used in many courses in varying degrees either as an option which complements existing pedagogies and enables students to

trial new ways of learning, or as a replacement for some face-to-face teaching. In either case, the essential course design has not been altered. In some courses however, CMC is an integral part of the course such that students have to use it in order to succeed. In fact numerous courses have been offered entirely online. Research cited by Mason and Kaye (1989) indicates that the success of the medium and the extent to which students use it depends ultimately on whether usage is optional or compulsory. In fact, according to Harasim (1990), research suggests that CMC is most likely to reach its potential when it is the primary teaching medium. However, in regard to traditional face-to-face classrooms, research cited by Holden and Wedman (1993) has suggested that CMC is more beneficial when used in conjunction with face-to-face teaching, rather than as a replacement for it.

In regard to the use of the medium, Harasim (1989) researched participation patterns of students and found that undergraduate students used it during weekdays while students with work and family commitments used it during the evenings and at weekends. Grabowski, Suciati and Pusch (1990) found that students did not use the medium if it was inconvenient to access or if they had no need to use it. A lack of knowledge about how to use the technology also prevented them from using it.

Research has identified a number of difficulties associated with the use of CMC which has some impact on its effectiveness. For example, Hiltz (1986) found that students may feel socially awkward about communicating via CMC because it lacks a sense of the personal. Harasim (1987) found that students had difficulties with the unique features of CMC including the asynchronous nature of it and the amount of information stored, while Davie (1989) noted the technical difficulties, the problems associated with working on a small screen, and the anxiety which students feel about their written contributions. In regard to learning outcomes, experimental studies by Hiltz (1990) indicate that, by and large, students learn as well via CMC as they do via traditional delivery modes. Highly motivated students and mature-aged students learn more through this medium, while less motivated students with poor study skills learn less. There is a clear need for further research into the pedagogical aspects of CMC to determine how teachers teach, how students learn and in particular what they learn.

Constructivist principles of teaching and learning

In general terms, constructivism can be regarded as a set of epistemological theories and philosophies, the central tenet of which assumes that knowledge cannot be taught but must be constructed by the learner in response to experience. It is through experience that people constantly participate in the social construction of "reality" where forms of understanding depend on the fluctuating circumstances of social processes. According to von Glaserfeld (1987), the father of contemporary radical constructivism, the conceptual constructs which we call knowledge arise in the experiential world of the knowing subject. Coming to know then, is the result of interpretive and negotiation processes which enable the learner to construct or map viable representations of the reality of their experience. Radical constructivism uses the concept of "fit" as a substitute for the conventional concept of truth as being a "match" for reality. In these terms, there is no way of replicating an intended meaning; rather, concepts and thoughts can only be tested for compatibility which cannot assume sameness.

Within a constructivist theoretical framework, control over the learning process clearly resides with the learner. Candy (1990, p. 8) encapsulates the relationship between constructivism and teaching and learning with these words:

constructivism in education is concerned with two things: how people construe (or interpret) events and ideas and how they construct (build or assemble) structures of meaning. The constant dialectal interplay between construing and constructing is at the heart of a constructivist approach to education, whether it be listening to a lecture, undertaking a laboratory session, attending a workshop, reading a text, or any other learning activity.

To say that the learner is in control of the learning process is not to

say that the teacher's role is irrelevant. On the contrary, the teacher has the significant task of facilitating the "dialectal interplay between construing and constructing" while engaging in the same process on the level of their own learning about teaching. Educative processes need to provide the maximum opportunity for learners to "reconstrue" ideas and events so that they are not locked into particular interpretations and constructions. Socially valued knowledge is continually created and re-created by members of a community through an interactive negotiation process. To be consistent with constructivist principles as espoused by von Glaserfeld (1987), learning can be regarded as follows:

- It is a social interactive process which occurs through group communication.
- It is an empowering process which is controlled by the learner rather than the teacher.
- Feedback is a crucial element in the "construing, constructing, re-construing, reconstructing" process.
- Constructivism demands that teachers act as facilitators of knowledge-building rather than transmitters of information.
- Teaching dialogue is directed towards modifying students' cognitive structures.
- The validity of the state of thought of a student is emphasised, therefore the deficit model of a learner is not acceptable, indeed is rendered irrelevant.

If we juxtapose the pedagogical principles which underpin constructivism with the essential features of CMC, a number of parallels can be drawn which indicate that there is enormous potential for the construction of knowledge within the CMC environment. In particular, the notions of learner direction and control, group interaction and collaboration, possibilities for feedback and the negotiation of meaning through continued dialogue are key features in each case.

Deakin's Computer-based Communication System

An electronic communication system called the Tutorial and Electronic Access System (TEAS) has been established at Deakin University to support the delivery of flexible teaching and learning programs and to facilitate communication in its multimodal, multi-campus environment. The system can be accessed through a computer terminal linked to AARNet, the national university network system, or via the telephone using a computer and modem.

Currently, nine TEAS groups are operating at Deakin, seven of which service students enrolled in courses across various discipline areas, one which services students enrolled in professional development and continuing education courses, and one which supports postgraduate and higher degree research students. There are numerous facilities available on the TEAS systems, including asynchronous or synchronous individual communication via email and talk, open and closed bulletin boards for group communication, facilities to access library catalogues and databases, a library book-ordering service, access to

administrative information and directories and file transfer facilities. In addition, there are facilities for online assignment submission, and for uploading to and downloading from email and bulletin boards.

According to Thompson (1994), network services are designed to be user friendly and to meet the specific learning and support needs of students in the various groups. Accordingly, while some features including electronic mail, opportunities for synchronous communication and access to library resources and common bulletin boards, are common to all groups, other aspects such as closed group boards, directories and online databases are established according to specific group needs.

The Deakin system is clearly consistent with Feenberg's (1989) claim that the most powerful and effective systems are the ones which are able to cater for multiple needs and are based on a simple user interface.

In regard to accessing the systems, on-campus students enrolled in courses or units being served by TEAS are provided with passwords irrespective of whether or not they are interested in the medium. However, only those off-campus students who have registered their interest in using CMC are able to access the system.

The existing Deakin TEAS systems are presently being reviewed with the prospect of replacing them with more sophisticated systems featuring a graphical user interface, easier file transfer facilities and applications to speed up connect time. Numerous other features will be incorporated into the new system which will significantly broaden opportunities for group communication and collaboration.

Gathering Data for the Study

The predominant aim of this study was to identify the factors which constrain students' use of CMC to assist their learning. Data for the study have been gathered from a series of interviews undertaken in the following ways:

- Telephone interviews have been conducted with 28 on-campus students and 25 off-campus students in three TEAS groups, including two course-based groups and the postgraduate group. The interviews focused essentially on the facilities which students found most useful and on the factors which constrained their use of the medium. Notetaking was used to record data from these interviews.
- Face-to-face interviews were conducted with coordinators of the three groups, the systems analyst and with the lecturer responsible for implementing the system. Two of these interviews were tape recorded, while notetaking was preferred by the remaining three interviewees.

Findings of the Study

Most Commonly Used CMC Facilities

Since students who use the TEAS systems come from diverse backgrounds, their knowledge of, and experience with, computers varies considerably and has some impact on the level and nature of participation in online activities. As described above, there are numerous facilities available on the TEAS systems, but at this stage of the implementation process, relatively few students make use of all the facilities available. By and large, the postgraduate and higher degree students most appreciated the TEAS system, and made more use of facilities than students in other groups. In particular, wherever possible, they used email to communicate with their supervisors, they searched the library databases and used the book ordering facility quite frequently. Some postgraduate students contributed to bulletin board discussions, but others were not interested in the discussion topic or did not need the social chit-chat.

The use of the medium by other off-campus students varied quite considerably. In the main, it was used to order books from the library or to communicate with lecturers and other students, though the numbers of students who joined online tutorials was quite small. A number of

them commented that they had not made as much use of some of the facilities as they would have liked, for reasons which will become apparent.

On-campus students made very little use of the medium; of those interviewed, only five students had used it at all, two to communicate with academic staff and the other three to check whether there was information on the bulletin boards. When they found nothing there, they didn't logon again.

Constraints on the Use of CMC

Although there is clear evidence in the literature that the use of CMC has enormous potential for enhancing learning and supporting students in their endeavours, it appears there are still a number of attitudinal, technological and institutional barriers to overcome before it becomes an accepted, effective alternative paradigm. This study confirms the research findings cited earlier in regard to the factors which constrain usage. The most telling factors appear to be limitations of access, lack of time for online work, failure to meet students' needs, the relative value of online activities, acculturation factors, lack of knowledge, and technical difficulties.

Limitations of access

For many students, one of the major constraints on their use of CMC is the type of access which they have been able to arrange, that is to say the convenience of the arrangements, the time taken to travel to the venue where access has been arranged, and the cost of access.

Although privately owned computers are becoming increasingly common, ownership of modems is far less common. Many students do not have modems in their own homes and therefore have to travel elsewhere to

access the system. For example, the majority of on-campus students interviewed did not have their own equipment, and could only access CMC in the computer laboratories on-campus. The number of computers available was limited and were frequently being used by students studying in other courses. After finding that computers were not available when they wanted to use them, most on-campus students no longer bothered. For a minority of off-campus students, the inconvenience of having to access CMC at a nearby institution or at the home of a relative or friend was a factor which constrained their use of it.

The majority of off-campus students interviewed did own their own computer and modem, hence in terms of convenience, they were not limited. For some of the more distant students however, the costs associated with using a modem via STD limited the number of times they could access the system as well as the length of time they could stay online. They tended to logon after 10pm or on Sundays because telephone rates are cheaper then.

Lack of time for online work

Time was a limiting factor in other ways too. Several students, both on-campus and off-campus mentioned that time was a factor which constrained them. For example, they didn't have enough time to familiarise themselves adequately with the technology because of other more immediate commitments. Even for those who had the necessary technological knowledge, the process of gaining access to the system was sometimes very slow particularly if their equipment was somewhat unsophisticated. For many students, both on-campus and off-campus, the time allocated for study purposes was limited and for them, the priority was to attend to course requirements such as reading, writing assignments, or studying for examinations.

Failure to meet students needs

It is clear that the use of technology will be non-existent or at least severely restricted if it does not meet the specific, and sometimes idiosyncratic, needs of students. The overwhelming majority of on-campus students interviewed have not used CMC because they didn't need to. If they wanted to communicate with their tutors, they could do so face-to-face whenever they were on campus. In other words their need for interaction, clarification of concepts and work requirements was most adequately met in traditional ways. As one student so aptly put it: Why move to these methods of communicating when phones, faxes and face-to-face approaches are readily available?

For a number of off-campus students, CMC compensated for the absence of face-to-face, group interactions, so their need to reduce the isolation of off-campus study ensured a greater readiness to use the facilities provided by TEAS. In particular the crucial needs of postgraduate students for contact with supervisors, access to library resources and discussion groups were well catered for in the CMC environment, hence

their participation was high commensurate with other groups. However there were a number of off-campus students who, while still claiming to be interested in the medium, felt that they had achieved quite well without it. Clearly, they did not need to use it.

Value of online activities

The educational value derived from using a new technology needs to be commensurate with the costs of accessing it. Some students have been quite quickly deterred from using TEAS because after having spent time and sometimes money to logon, they have found there is nothing valuable on the bulletin boards or on their email, or they have found that insufficient numbers of students have contributed. It appeared that often the same few students contributed to tutorial discussions via the bulletin boards. For them, the lack of a critical mass of people using the system limits the potential of online discussions because it doesn't provide the variety of ideas which ensure that online discussions are valuable.

Another problem which some students mentioned was that the lecturers in particular units did not value the technology and were not committed to ensuring that online activities were useful and plentiful. As one student commented: It is up to the lecturers to make it worthwhile. Certainly, there is evidence from this study which indicates that the extent of the commitment of the coordinating lecturers was directly related to the usage rates.

Acculturation factors

For some off-campus students using TEAS systems, there is a reasonably high degree of awareness about what the technology can do for them and how they can use it to meet their particular needs. The fact that CMC has helped to reduce their feelings of isolation and allowed them opportunities for group interaction and communication with lecturers, which would otherwise be unavailable, indicates that to a large extent they have been acculturated into the process of learning through technology. It has become a routine part of their study habits.

However, this is not the case with other off-campus students and with the majority of on-campus students. They take for granted an educational culture where the ways of learning and communicating represent a major barrier to the use of the TEAS system. The idea of using CMC to communicate with lecturers, tutors and other students is not part of their thinking. A number of on-campus students indicated that it did not occur to them to use the TEAS system. They continued to do what they have habitually done, which is to see their tutors personally or contact them by telephone. This is the educational culture in which they are steeped, and which will require major change on the part of students and academic staff.

Attitudinal barriers

Many people in society adopt particular attitudes towards technology which limit their willingness to use it. Some are disinterested, some

are lazy when it comes to learning new skills, and others become anxious about it to the point of experiencing technophobia. Somekh (1989) points out that if students have a self-image as non-technology people, it will act as a barrier to the complex process of change required to use the new medium.

As mentioned previously, on-campus students in courses where TEAS is used were all provided with the opportunity of logging on to the system irrespective of their attitudes and general level of interest in technology. Not surprisingly therefore, a number of them mentioned that they did not use TEAS because they were not interested in technology, while some others admitted they were too lazy to explore its potential. It is possible that some of the disinterest is a result of technophobia, though only a few students admitted to having an aversion to technology such that if it was possible to avoid it, they would. Interestingly though, off-campus students, particularly those in isolated areas, who were initially apprehensive about using technology were prepared to persevere with it and determined to overcome feelings of inadequacy. One student summed it up in this way:

I'm not very computer literate so I'm reticent about the whole thing but I'm determined to master it because I need it - I'm in such an isolated position here.

It appears that if the need is strong enough, and support is readily available as it is for most off-campus students, attitudinal barriers will be overcome.

Lack of technological knowledge

In the initial stages of introducing a new technology, one of the major constraints for students irrespective of their mode of learning is a lack of knowledge about how to use the technology and in particular what to use it for. Many on-campus students claimed they didn't know much about TEAS or how to use it. Even though they had attended a workshop early in the semester, they could not remember much about it and were disinclined to follow up the information.

Off-campus students have to be able to set up the communications software in their home, they have to learn how to use it, how to configure it to dial in, how to use file transfer from the TEAS system to their own system and so on. A number of off-campus students mentioned that because they were not experienced with computers, they found it difficult to understand the configurations required for use and had to be continually seeking help from other people, either their partners, friends or Deakin staff. This tended to restrict their use because they were reticent about constantly imposing on others.

Kaye (1989) refers to the fact that students using CMC have to master the technological and social dimensions of the medium before its educational potential can be realised. Certainly, this study provides clear evidence that insufficient understanding of the technical aspects of the medium can lead to frustration which deters students from using it.

Reticence about using written communication

A few on-campus students mentioned that they did not like communicating by writing especially when it was going to be read by a number of people. They intimated that oral communication is less threatening and more transient, hence they feel more comfortable with it. Although the evidence for this factor is small, it can be assumed that it may be a barrier for many other students in any situation where they are obligated to use the medium. If students can choose whether or not to work online, perhaps it would not be an issue.

Technical difficulties

As might be expected with any large communications system, sometimes there are technical difficulties which prevent students from gaining access to the medium or which cause problems when they are working online. Many of the difficulties are beyond the control of students, but nevertheless they do cause frustrations. A number of students interviewed in this study had difficulties accessing the system because of the inaccessibility of some equipment. These findings are consistent with those of Cuskelly and Gregor (1993) in that regard.

Overcoming the barriers

In the Deakin context, a number of the constraints discussed above have been foreshadowed and mechanisms have been, or are being, established to help overcome the barriers experienced by students. These include:

- Low cost access is arranged for as many students as possible by arranging reciprocal rights with other institutions, or by informing students about options such as AIDNET modems or AUSPAK.
- There is ongoing evaluation of each TEAS system to ascertain what facilities and support students need. As resources permit, these needs are responded to as quickly as possible.
- Discussion groups for coordinators have been established to enable them to share ideas about the use of the medium and to help solve problems which arise. It is hoped that this form of staff collaboration will help to increase the value of online activities. In addition, staff development workshops are often provided to familiarise people with CMC
- Staff appointments have been made to assist students in setting up the required equipment in their homes, to provide technical help in solving problems, and to provide ongoing support and advice about how to use the medium effectively.

Conclusion

The findings of this study indicate that while there is an increasing degree of willingness on the part of some students and staff to trial the CMC medium in their courses, there are still a number of barriers to be overcome before the full potential of the medium to enhance learning can be realised.

It appears that the most critical issues relating to the use of CMC are the nature of the access arrangements which students have organised, the learning needs of individual students, and their attitudes and willingness to work in a technological environment. At this stage, technology is not integrated into the everyday activities of academics and their students, that is to say it is not part of their culture. Until it is, CMC will be underutilised. It can be assumed that acculturation factors will diminish as more and more people become accustomed to the medium, but that is a process which will take time. This study provides some evidence to suggest that irrespective of whether the use of CMC is voluntary or mandatory, off-campus students will use it if they have convenient, cheap access and if it meets particular needs which are not satisfied in other ways. However, further research is needed to substantiate this.

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