

Evaluation of Videoconferencing as a Potential Communication Channel for E-Business

Ana Hol
Robyn Lawson

School of Computing and Information Technology
University of Western Sydney
Penrith South DC, Australia
e-mail: a.hol@uws.edu.au

Abstract

Communication technologies reduce the need for a physical presence. This paper presents preliminary findings from a study undertaken to explore whether videoconferencing can be classified as a successful method for e-collaboration both within an organisation, and with business partners between organisations. Results indicate that perceptions of users such as non-verbal cues, and audio-visual capabilities of the technology such as symbolic information are important indicators of videoconferencing as an effective communication channel. To increase adoption rates factors of training and awareness need to be considered. Electronic communication has changed the way work is undertaken, videoconferencing has the potential to change the way collaboration is undertaken.

Keywords

E-collaboration technologies, e-business, videoconferencing, communication channels

INTRODUCTION

The evolution of Internet based e-business has led to an increase in the use of electronic communication channels in establishing and maintaining relationships with business partners and with employees across different locations. Groupware technologies such as Notes/Domino and Exchange/Outlook are extended email systems that allow for the creation of the virtual organisation (Gloor, 2000). In addition to these, technologies such as teleconferencing and videoconferencing are methods that allow communication without a physical presence. This offers the opportunity for improved communication, and reduced costs associated with travelling time for meetings, and physical space. The analysis of virtual meetings goes beyond the implementation of the technology. To be effective as a collaborative decision-making technique, the perceptions of users need to be identified and addressed.

E-businesses are called virtual organisations based on the organisation's ability to communicate using electronic groupware technologies and mobile phones. However, these organisations do not engage in virtual collaboration with business partners to close business deals, make project decisions and write documents (Chau & Turner 2002). This type of collaboration could be enhanced with the effective use of videoconferencing to facilitate decision-making. When considering that business-to-business electronic commerce is the most rapidly growing segment, team-based activities will continue to develop within organisations and between organisations to achieve a common goal.

Organisational communication and information sharing have the potential to affect performance of individuals within the organisation, as well as performance of teams. Electronic communication has changed the way work is undertaken to encompass more virtual methods, and in doing this has made the movement of information more rapid and in larger amounts. Virtual team management and effectiveness are now receiving attention, due to the direct nature of the communication between individuals and teams and the elimination of intermediaries within the organisation, and on the supply chain (Rafaeli & Ravid 2003).

Teams have been defined as two or more individuals who interact to achieve specific objectives (Weaver et al. 1997). Virtual teams can achieve this interaction from different geographical areas (Duarte 2001), and the communication is generally by electronic means, mainly email and to a lesser extent videoconferencing. Virtual teams are very dependent on communication for their effectiveness, and can be activated for a range of e-business activities. Certainly, today's e-businesses are faced with the problem of lack of time for team meetings, and the subsequent loss of productivity on the core business strategies. This problem is compounded when collaboration is necessary on a global basis. Managers in a US study reported that they now have less time to

make decisions, and that a number of opportunities had been missed (Sandahl & Hewes 2001). Therefore, virtual meetings have the potential to improve the organisation's decision-making processes.

Collaboration technologies refer to information and communications technologies (ICT) that are used at the individual, and at the group level within the organisation and between organisations. Increased importance has recently been placed on these technologies for collaboration of virtual teams in a global environment (Bond et al. 1999). Grudin & Poltrock (1997) identified that communication, information sharing and coordination as functions of collaboration technologies that are beneficial to e-business organisations in today's global environment.

Certainly, electronic forms of communications have a significant role in enhancing e-business processes at the individual and at the organisational level, to the point where email and Intranets are now accepted as necessary technologies. Media richness theory (Daft & Lengel 1984) has been utilised as a framework when analysing communication technologies. This theory asserts that technologies are chosen and used based on the attributes of the medium, for example, speed, bandwidth and ability to personalise language. According to Daft & Lengel (1986), rich media conveys complex and equivocal messages. In order to assess whether information conveyed is rich it depends on the ability of a medium to convey and provide speed and availability of feedback, presence of body language, tone of voice, feelings, emotions and thoughts and the ability to use language to the full capacity (Dennis & Valacic 1999, Whittaker 1999, Irani 1998, Knapp 1997). Like media richness theory (Daft & Lengel 1984), social presence theory (Short & Williams 1976) stresses the importance of the ability to receive non-verbal cues to understand transmission of messages. The use of collaboration technologies that utilise features of rich media have the potential to enhance an organisation's decision-making processes, between different locations within the organisation, or between organisations regardless of location. In addition, participants need to view the communication channel that is being used as a rich medium (Carlson & Zmud 1999).

Research into email as a collaboration technology has provided accounts of successful implementation to the point where it is now part of business processes. The analogy with traditional mail is viewed a factor, as well as the intuitive nature of email to employees (Bullen & Bennett 1990). As most employees today use networked computers for their work, no special technologies are required. However, implementation of email usually does not include an emphasis on training or guidelines, which can result in the technology not being used ineffectively (Munkold 2002).

Groupware technologies such as email extend social space where communication is facilitated between members of a team (Jerram et al, 2002). However, these technologies have constraints that inhibit their effective use as an organizational tool. These constraints are based on conflicting assumptions, which hinder communication being built on shared foundations between virtual teams. A study by Rafaeli & Ravid (2003) supports the notion that information sharing by use of email between members of a team had a positive impact on performance of the team. For e-business organisations this raises an issue associated with the use of collaboration technologies for virtual meetings that span a number of organisations. Email uses written communication and misinterpretations are possible. Conversely, videoconferencing utilises verbal communication, which includes non-verbal cues such as body language and voice tone (Bates & Gregory 2000). Videoconferencing is viewed as not being as effective as face-to-face meetings due to selective attention and inability of participants to take initiative in conversation (Mullin et al. 2002, Kock 1999, Slipera 1996, Tang & Isaacs 1993).

Business communication can be improved by the introduction of new technologies. Currently, the use of email and mobile technologies are evident for making decisions and carrying out business plans. Videoconferencing could be used to further enhance these decisions, significantly reduce misconceptions, and also to better understand messages taking into the account media richness cues. The use of videoconferencing in organisations has been much slower than email adoption. High investment in the technologies, and the steep learning curve of users has been highlighted as inhibiting factors (Sanderson 1992).

The aim of this paper is to explore whether videoconferencing can be classified as a successful method for e-collaboration both within an organization, and with business partners between organisations. Specific objectives of this research were to identify:

- *perceptions of users of videoconferencing technologies as a communication channel; and*
- *issues that enhance the effective use of videoconferencing technologies.*

A further objective is to:

- *evaluate the potential of videoconferencing as a communication channel for e-business organisations.*

THE STUDY

To address the first two aims of the research, a study was conducted with staff members of the University of Western Sydney. UWS is a business that, in some instances, operates as a virtual workspace as people who work in different departments, schools and campuses do not necessarily know one another. In addition to this, UWS utilises e-business processes such as meeting management strategies, groupware technologies, electronic ordering, tracking and delivery systems and also manages e-payments.

The subjects of the study were located on the various campuses, and had at least two years experience with videoconferencing facilities. The staff members were required to communicate via the medium with their colleagues who are located at various campuses in order to grasp, manage and organise information and also make constructive decisions.

Two instruments were used to collect data, a questionnaire and a focus group. The questionnaire was designed after a careful analysis of available data from previous research and was divided into sections, namely facial expressions, audio-visual capabilities, symbolic information and videoconferencing participants. Some questions required short written answers, while others required a selection of either of three boxes, choices being: "Yes" meaning I agree with a statement, "No" meaning I do not agree with a statement and "Don't Know" meaning I am not really sure. A variety of questions were used in order to depict conformity between answers.

The questionnaires were administered via the University's Internal E-Mail and Intranet Web site. The staff across six UWS campuses had access to the questionnaire, namely academics (professors, associate professors, senior lecturers, lecturers, associate lecturers and tutors), technical personnel and administrative officers. The advantage of an electronic submission was that subjects had freedom to participate from any location, save time and return completed questionnaires automatically without delays. The sample that chose to participate consisted of 49 males and 47 females (response rate 13%). The questionnaires were collated and the answers analysed. The open-ended questions were qualitatively analysed and categorised, while close-ended questions were analysed using SPSS computer.

The questionnaire findings were followed up by a focus group discussion. The participants for the focus group indicated their interest by completing the section at the back of the questionnaire. The focus group was conducted in order to help understand perceptions videoconferencing users hold, as well as pinpoint possible hurdles and outline how these obstacles might be overcome.

The focus group consisted of seven UWS staff members who were based at Bankstown campus and five staff members who were based at Penrith. A one-hour videoconferenced discussion was led by one of the authors in order to gather and evaluate the effectiveness of videoconferencing as a communication channel. Issues that emerged as important and relevant from the survey analyses were discussed and further elaborated. Discussion also reflected the Information Richness Theory. The outcomes of the study were then used to address the third aim of the research, which was to evaluate and predict the potential of videoconferencing as communication channel for e-business organizations.

RESULTS

The overall aim of this paper was to explore whether videoconferencing can be classified as a successful method for e-collaboration within an organisation, and with business partners between organisations. The first objective was to identify perceptions of users of videoconferencing technologies as a communication channel. Issues of facial expression, and verbal and non-verbal cues were evaluated. Also, audio-visual capabilities of videoconferencing such as the picture-in-picture technique, and presentation of symbolic information were examined. The importance of the meeting chair, and participants knowing each other at the various locations was investigated.

Perceptions of users of Videoconferencing as a communication channel

Facial Expressions

	Value	d f	Asymp.Sy g (2-sided)	Exact.Syg (2-sided)	Exact.Syg (1-sided)	Point Probabilit y
Pearson Chi-Square	18.717 ^a	4	.001	.001		
Likelihood Ratio	19.610	4	.001	.001		
Fisher's Exact Test	17.346			.001		
Linear-by-Linear Association	14.943 _b	1	.001	.001	.000	.000

N of Valid Cases

96

- a. 3 cells (33.3)% have expected count less than 6. The minimum expected count is 1.83
 b. The standardized statistic is 3.866.
 p**<0.01

Table 1: Facial expressions and ability to grasp meaning

From Table 1 it can be seen that there is a strong relationship between the two issues, first being that facial expressions are equally important in both videoconferenced and face-to-face meetings and, the other issue being that it is equally easy to grasp meanings via both videoconferenced and face-to-face meetings. It seems that there is a significant relationship between the two issues [Chi-square - $X^2(4)=18.72$, $n=96$, $p<0$. Fisher's Exact test =17.36, $p<0.01$].

Audio-visual capabilities

Videoconferenced focus group participants stated that they have found picture-in-picture capability to be very useful and an important aid in message understanding. Each end had two television sets and they were used to transmit cues from both ends, ensuring that participants were able to see themselves on one screen and on the other screen see the far site and the slides. In addition, 61.5% of respondents to the questionnaire stated that close-up shots were useful and an important message carrier.

	Value	d f	Asymp.Sy g (2-sided)	Exact.Syg (2-sided)	Exact.Syg (1-sided)	Point Probabilit y
Pearson Chi-Square	14.551 _a	4	.006	.006		
Likelihood Ratio	17.464	4	.002	.002		
Fisher's Exact Test	13.178			.006		
Linear-by-Linear Association	7.813 _b	1	.005	.006	.003	.001
N of Valid Cases	96					

- a. 2 cells (22.2)% have expected count less than 6. The minimum expected count is 1.69
 b. The standardized statistic is 2.795.
 p**<0.01

Table 2: Audio-visual capabilities and understanding

From Table 2 it can be seen that there is a significant relationship between two issues, one being that in videoconferencing sessions slides are usually transmitted alone so that a person talking is not always seen by remote participants and the other issue being that there is importance of using close-up shots of the person talking so that non-verbal language can easily be observed [Chi-square - $X^2(4)=14.55$, $n=96$, $p<0.01$, Fisher's Exact test =13.18, $p<0.01$].

Symbolic Information

	Value	d f	Asymp.Sy g (2-sided)	Exact.Syg (2-sided)	Exact.Syg (1-sided)	Point Probabilit y
Pearson Chi-Square	27.311 _a	4	.000	.000		
Likelihood Ratio	27.403	4	.000	.000		
Fisher's Exact Test	26.251			.000		
Linear-by-Linear Association	17.733 _b	1	.000	.000	.000	.000
N of Valid Cases	96					

- a. 1 cells (11.1)% have expected count less than 5. The minimum expected count is 4.96
 b. The standardized statistic is 4.211
 p**<0.01

Table 3: Symbolic information and message understanding

Table 3 shows the importance of using symbolical information (for example, a picture of a microphone, an icon of an organisation) as an aid to message understanding. Both words and pictures need be used in order to

explain, understand and elaborate on the information discussed in videoconferenced meetings [Chi-square - $X^2(4)=27.31$, $n=96$, $p<0.01$, Fisher's Exact test =26.25, $p<0.01$].

There is also a significant relationship between the importance of using site names and posting an agenda prior to the meetings [Chi-square - $X^2(4)=25.83$, $n=96$, $p<0.01$, Fisher's Exact test =12.72, $p<0.01$]. These strengthen the importance of symbolically presented information. Furthermore, the focus group participants concluded that low variety language could be transmitted via computer generated images or a document camera, which would be useful when transmitting statistical or mathematical data.

Videoconferencing Participants

The focus group participants have stated that discussions can be easily carried out between the two sites as long as participants are willing to collaborate. They also think that a meeting chair would need to be involved in order to channel and focus discussions. It was found that 55.2 % of questionnaire respondents consider it important to meet face-to-face prior to videoconferenced meetings.

	Value	d f	Asymp.Sy g (2-sided)	Exact.Syg (2-sided)	Exact.Syg (1-sided)	Point Probabilit y
Pearson Chi-Square	21.181 _a	4	.000	.000		
Likelihood Ratio	19.554	4	.001	.001		
Fisher's Exact Test	18.854			.000		
Linear-by-Linear Association	9.024 ^b	1	.003	.003	.002	.001
N of Valid Cases	96					

a. 5 cells (55.6)% have expected count less than 5. The minimum expected count is 1.97

b. The standardized statistic is 3.004

$p^{**}<0.01$

Table 4: Previous meeting of participants and understanding

From Table 4 it can be seen that there is a significant relationship between the two issues. First stating that having met people previously assists individuals in interpreting messages in videoconferencing sessions, and the second being that it is also important to know those individuals and have met them prior to videoconferenced meetings face-to-face in order to carry out successful videoconferenced discussions. [Chi-square - $X^2(4)=21.20$, $n=96$, $p<0.01$, Fisher's Exact test =18.85, $p<0.01$]

As outlined by the focus group participants videoconferencing is useful and an important media of communication as it saves time, money and also allows experts, business partners or customers to share their knowledge, ideas and future plans with one another. Furthermore, 92.7% of questionnaire respondents noted that in order for them to use current technology to the maximum of its potential there is a need for them to know what is available at the market, and also know how to apply and use these technologies.

Issues that enhance the effective use of Videoconferencing technologies

An analysis of the results presented on perceptions of users of videoconferencing technologies, reveal the issues that enhance the effective use of videoconferencing technologies can be summarised as:

- non-verbal cues such as facial expressions are important to grasping meaning;
- audio-visual capabilities of the technologies such as presentation of symbolic information aid in understanding;
- need for a meeting chair to focus the discussion; and
- preference for the participants to have previously met face-to-face.

Suitable training and awareness related to these issues would see the concentration of the participants on the purpose of the meeting, instead of a focus on their inability to use the videoconferencing technologies effectively.

Evaluation of the potential of Videoconferencing as a communication channel for e-business organisations

This study has demonstrated that there are a number of issues to be addressed by organisations considering using videoconferencing technologies for collaboration. The participants had used the technologies over a period of years and identified factors that enhance this type of collaboration. To increase adoption rate of videoconferencing the factors of training and awareness need to be considered. Acknowledgement that this type of communication channel is richer than email, and can be used for collaboration within organisations, and between business partners between organisations, is imperative to ensure videoconferencing is not rejected as unsuitable as a communication channel.

DISCUSSION

The results of this study found that while videoconferencing technologies are available and have a number of audio-visual capabilities, they are not intuitive to users, and have issues that need to be addressed to ensure effective use as a collaboration technology.

Findings on perceptions of users of videoconferencing as a communication channel have highlighted the importance of non-verbal cues, and support previous findings (Irani 1998, Knapp 1997). These cues include perceptions of gestures, postures, eye behaviour and vocal cues (Bates & Gregory 2000). The ability to receive these cues was found in the focus group of this study, and supports Media Richness Theory (Daft & Lengel 1984) and Social Presence Theory (Short & Williams 1976).

Issues that enhance the effective use of videoconferencing technologies include audio-visual capabilities, the need for a meeting chair to focus the discussion, and a preference for the participants to have previously met face-to-face. Audio-visual capabilities were considered necessary for effective communication, with 61.5% of respondents to the questionnaire stating that close-up shots were very important in order for messages to be understood. Consequently, focus group participants agreed that close attention is to be given to the use of cameras and that close-up shots need to be applied in order for non-verbal cues to be transmitted.

In addition, findings from this study, emphasizes the need for the presentation slides to be transmitted in addition to the close-up shot of the speaker. These results support research that states both verbal and non-verbal symbols were critical for message understanding (Dennis & Valacic 1999, Whittaker 1999). Focus group participants concluded that the availability of audio-visual capabilities increases message understanding. One of the advantages of the picture-in-picture capability is that it allows for one image to be transmitted centrally, in the middle of the screen, while another image is in one of the screen's corners. This allows for both images to be transmitted simultaneously.

Symbolic information that can enhance message understanding was another crucial factor in this research. It seems that words and images have different spans and reach individuals in different ways (Tang & Isaacs 1993). Therefore, in order for everyone to gain understanding, information needs to be transmitted both ways. Focus group participants supported the findings of the questionnaire, which stated that symbolic information is very important when making decisions. To further stress the importance of symbolic information, it was concluded from this study that it is highly desirable to use site names and to post the agenda prior to the meeting. This is in addition to computer-generated images and slides.

The need for a meeting chair was highlighted during the focus group. The role of the chair was to focus the discussion. This idea is in line with research, which contends that there is a possibility to involve facilitators or a meeting chair (Kock 1999) so that participants can easily ask questions and clarify any possible misunderstandings. This notion can be taken a step further to include a facilitator at each location, who could work with the meeting chair to guide discussion at the various locations and provide integration. This would enhance decision-making and ensure all views were taken into consideration.

To overcome stated inefficiencies in videoconferencing, namely selective attention and inability to take initiative in conversation (Tang & Isaacs 1993), 55.2% of respondents to the survey considered it important to meet face-to-face prior to their participation in videoconferenced meetings. This was found to strengthen the relationship between participants and allow them to freely participate in videoconferencing. This finding supports research by Mullin et al (2002) and Slipera (1996). Videoconferencing was found to be a convenient medium, via which participants can communicate, make strategic decisions and consequently collaborate by saving both time and money.

When evaluating the potential of videoconferencing as a communication channel for e-business organisations, the ideas of saving time and money are very attractive. In addition, if the medium is shown to be effective, then e-businesses will benefit by its use as a collaboration technology in today's global environment. Issues of awareness of what is available would need to be addressed, as well and training in how to use the technology effectively. Most of the respondents (92.7%) to the questionnaire in this study believed that awareness and

training were essential. Certainly, not knowing what to expect and how to use the technology can lead to misuse, non-acceptance and consequent misunderstanding (Kock 1999). In e-business this could lead to rejection, particularly as face-to-face meetings are the accepted custom. To fully or partially replace the existing practice, the technology needs to be available, effective and acceptable to the users, who can use it to its full potential.

In exploring whether videoconferencing can be classified as a successful medium for e-collaboration, it is acknowledged that it is a leaner medium than face-to-face communication, but still richer than any other communication medium available today. Used effectively, videoconferencing can convey complex and equivocal messages. As such, videoconferencing can be claimed to have the potential to complement existing means of collaboration with the organisation to share knowledge and enhance the decision-making processes within the virtual team, and with business partners between organisations.

Collaboration technologies such as groupware technologies, for example email and videoconferencing are available (Rafaeli & Ravid 2003, Jerram et al. 2002). These types of technologies are selected based on attributes such as speed, and ability to personalise language (Daft & Lengel 1986). Both email and videoconferencing possess these attributes. Email has been embraced as a communication tool, however, videoconferencing has not received the same recognition. This study has highlighted the need to look beyond the technologies, and focus on users' ability to effectively use the videoconferencing system to truly gain maximum benefit for the organisation. Essentially, participants need to learn to perceive the channel, via which they are communicating, as rich (Carlson & Zmud 1999).

CONCLUSION

The aim of this paper was to explore whether videoconferencing can be classified as a successful method for e-collaboration to make project decisions, close business deals and write documents, both within the organisation and with business partners between organisations. Certainly, using collaboration technologies such as videoconferencing to enrich decision-making processes can enhance the evolution of e-business. In this way, virtual teams can utilise email for communication and videoconferencing for collaboration.

This study has demonstrated that videoconference users need to be aware of the technology that they are using, particularly camera positions and ways that information is captured and transmitted. Issues that enhance the effective use of videoconferencing include non-verbal cues, audio-visual capabilities of the technologies, the need for a meeting chair to focus the discussion and a preference for participants to have previously met face-to-face. In an e-business sense, this last issue may not be feasible. However, in order to address this problem it may be possible to arrange telephone contact rather than email before the meeting, to allow participants to know each other. This would bring in at least some element of non-verbal communication, which this study has identified as being very important. Alternatively, a set of protocols could be developed that would allow for an informal self-introduction and perhaps a question and answer session, before the real business of the meeting begins. Needless to say, this suggestion would add to the importance of the meeting chair. Addressing this, and the other issues can lead to videoconferencing being a successful method for e-collaboration. In addition, this will enable participants to communicate as virtual organisations, and in turn save time and money. Of course, in order to be successful it is essential for business partners to be familiar with the technology they are using.

Limitations to the study centre on the use of videoconferencing in academic and administrative settings, rather than a formal business setting, resulting in the inability to completely generalise the findings. As the university is representative of a large organisation in this context, and participants had experience in using the technologies, this study can form a framework for future studies that are undertaken in formal business settings. Comparative analysis would then be possible. As an initial study in the area, this study can be viewed as preliminary findings, which can be extended in future studies. Comparisons between various focus groups, and different ways of collecting data are suggestions for the future.

The pace of electronic business and emerging technologies have been rapid in recent years, and in the area of communication technologies, email and other groupware technologies have become an integral part of business practices, and is viewed in much the same way as other more established technologies. Are organisations ready for another technology to further enhance the effectiveness of the communication channel?

The Internet has changed the way work is undertaken, and videoconferencing has the potential to change the way teams communicate, collaborate, share information and make decisions. The evolution of the use of electronic communication channels in establishing and maintaining relationships with business partners and with employees, may see the notion of a physical presence further reduced. In the current global environment, the concept of using videoconferencing as an effective communication channel for e-business has potential.

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