

# One-to-One Video-Conferencing Education

**Hock Chuan Chan**

*National University of Singapore, Singapore*

**Bernard C.Y. Tan**

*National University of Singapore, Singapore*

**Wei-Ping Tan**

*National University of Singapore, Singapore*

## INTRODUCTION

Technologies have become a critical component affecting teaching and learning effectiveness. Technologies enable informal computer-mediated interaction among instructors and students, for example, through electronic mail or bulletin boards. The Internet has changed the dynamics of teaching and learning by enabling distance direct personal tutoring, whereby a tutor (a private or personal instructor) provides personal additional instruction and attention to a student. The cost of video-conferencing using standard personal computers and off-the-shelf software involves a low set-up cost and very low usage fee (local phone charges). Its low cost can lead to a proliferation of its use. Students are no longer physically constrained in their quest for tutors. It is important to research the factors that may facilitate or hinder learning via Internet video-conferencing capabilities.

A case study was conducted, through multiple data collection methods, with two tutors and three students in Singapore. The impacts of four critical factors (system characteristics, mode characteristics, social presence, and media richness) on the effectiveness of teaching and learning were studied. This study helps to fill a gap in knowledge that arises because prior studies tend to concentrate on big virtual classroom settings.

## BACKGROUND

Earlier studies on the use of information technology for education have focused on student usage of learning software, or on group interactions. For example, Sankar et al. (1997) investigated two different ways of delivering lectures with video-conferencing, without any instructor-student interaction. There are very few studies on one-to-one distance education. Graesser and Person (1994) found that the quality of student questions was correlated with grades in one-to-one tutoring sessions on mathematics.

It was found that collaborative problem solving, prompt question answering, and clarity of explanation using examples contributed significantly to learning effectiveness (Graesser et al., 1995). Hume et al. (1996), studying one-to-one tutoring effectiveness, found that hints encouraged students to engage in active cognitive processes that promoted long-term retention and deeper understanding. Chi (1996) found that certain types of interaction between tutors and students, during one-to-one tutoring sessions, could produce deep learning.

The body of literature on one-to-one distance education motivates this research effort in two ways. First, like all the existing studies, this study seeks to identify factors that may enhance the effectiveness of teaching and learning in such an environment. In this study, effectiveness is measured by asking instructors to indicate their perceived ability to teach and asking students to indicate their perceived ability to learn via distance education, relative to traditional face-to-face education sessions. Second, while the results of all the existing studies alluded to the importance of communication between the tutor and the instructor, this issue has never been directly investigated. Therefore, this study focuses on identifying factors that may impact the communication process between the instructor and the student, thereby affecting distance learning effectiveness.

One-to-one distance education is examined in the context of desktop video-conferencing because the economy and prevalence of desktop video-conferencing facilities are likely to make it a dominant mode of distance education in the future (Rhodes, 2001). Table 1 presents four critical factors that can affect the success of using desktop video-conferencing facilities for education.

## System Characteristics

Every desktop video-conferencing facility has both hardware and software components. A digital camera and a video card (in some products) are needed to capture images. A microphone, a sound card, and speakers are

*Table 1. Factors affecting teaching and learning effectiveness*

Factor	Key aspects of factor
System characteristics	Hardware, software, and bandwidth
Mode characteristics	Usefulness, challenge, attractiveness, and clarity
Social presence	Sociability, warmth, and personal focus
Media richness	Multiple cues and interactivity

needed to capture and project voices. Many windows are needed to display the captured images (of the tutor or the student), the chat window, and other applications such as Word. In addition, the software should facilitate document sharing. Bandwidth limitations on the Internet and processing speed could lead to grainy pictures and a lack of synchronization between video and audio signals (Tackett, 1995), thereby affecting teaching and learning effectiveness.

### Mode Characteristics

Four key perceptual characteristics of a mode of instruction determine its effectiveness: usefulness, challenge, attractiveness, and clarity (Champness & DeAlberdi, 1981; Sankar et al., 1995). Usefulness refers to how much the mode of instruction is perceived to be appropriate for the learning task. Challenge is the extent to which the mode of instruction is able to facilitate learning of difficult concepts. Attractiveness is the extent to which the mode of instruction is perceived to be lively, exciting, and interesting. Clarity refers to the extent with which the mode of instruction is perceived to allow comprehensible communication.

### Social Presence

Social presence is defined as the extent to which a communication medium allows the actual physical presence of the communicating partners to be conveyed, and how far it allows communicating parties to socialize with each other, feel the warmth of each other, and exchange messages that are personal in nature (Markus, 1994; Short et al., 1976). Short et al. (1976) rank the following five communication media in order of decreasing social presence: face-to-face, television, multi-speaker audio, telephone, and business letter. The literature suggests that desktop video-conferencing may enable people to transmit more warmth and sociability than the telephone. Video images can help people who have just met recently to become more familiar with one another (Czeck, 1995). Facial signals can allow the instructor to assess student understanding.

### Media Richness

Media richness is defined as the extent to which a communication medium can facilitate shared understanding (Daft et al., 1987). Rich media enable people to overcome equivocality, the existence of different interpretations. Variables typically used to gauge media richness include multiple cues and interactivity. Trevino et al. (1987) provide this ranking, in decreasing order of media richness: face-to-face, telephone, and printed documents. Face-to-face meeting has interactivity and immediate feedback so that mutual understanding between communicating parties can be checked and differences in interpretations reconciled. This medium also carries visual, verbal, and textual cues. Printed documents have neither interactivity nor immediate feedback. Desktop video-conferencing facilities may be less rich than face-to-face meetings because interactivity may be lower (Rice, 1992). Interactivity between the instructor and the student is a critical success factor for distance education (Milhem, 1996; Millbank, 1994).

## RESEARCH METHODOLOGY

A case study research approach is appropriate for examining a phenomenon in its natural setting, and it leads to in-depth answers (Yin, 2002). A prior survey with undergraduates and high school students revealed that most of them had no experience with distance education via desktop-video-conferencing facilities (Tan & Chan, 1998). Since this mode of learning was relatively new, the case study research methodology was employed. Five subjects (two tutors and three students) volunteered for this study. All the one-to-one tutoring sessions involved two individuals interacting with each other. However, the primary interest of this study was to identify factors that influence the communication efforts of an individual (tutor or student), thereby impacting his or her ability to teach or learn. Prior studies on one-to-one tutoring sessions have also focused on the perceptions of an individual, rather than the interaction between two individuals (Chi, 1996). The two tutors were undergraduates from a large university. They each had about 2 years of experience with one-to-one tuition in a traditional face-to-face context. The three students were attending high school.

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