The Quality of Telepresence Teaching and Learning

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ABSTRACT
This paper is intended to present the quality of telepresence teaching and learning. The telepresence system consists of robot cell enable students at any place to practically program and control a robotic system through Internet. This robot cell is one of the facilities in the Intelligent Automation Laboratory which is located in the Department of Engineering Management and Technology, Hong Kong Institute of Vocational Education (Chai Wan). This system is designed for staff and students as well as the public to learn robot programming and followed by the design of robot cell in flexible manufacturing systems.

A survey will be carried out to investigate if the use of telepresence system can enhance teaching and learning. The survey, consists of three research instruments, namely the questionnaire, semi-structured interview, and observation, is designed to generate both the qualitative and quantitative data. Quantitative data will include survey using questionnaires whereas qualitative research will include in-dept semi-structured interview and observation.

Semi-structured interview will be used to interview two groups of students (experiment and control group). Each student will be asked to spend 30 minutes to attend the interview. An interview guide will be prepared and used to explore the views of students and will be divided into four sections corresponding to the survey questionnaire for cross reference purpose.

Keywords: Telepresence, quality

1.0 Introduction

Telepresence is the technical term, as mentioned by NC State Reserachers (2001), for the feeling that one is actually present at a site far removed from one’s physical location. Many people have accidentally experienced this, but if researchers can determine exactly what triggers this sensation, then they can design virtual reality systems and interfaces that assist operators of remote robotic manipulators, or teleoperators, who need to be fully immersed in the experience for maximum efficiency.

Telepresence is the ability to function in a remote world. This can be thought as simple controlling of a remote machine (Draper, Kaber, and Usher, 1998). Draper (1999, p. 349) further indicated that telepresence may be though of as the degree to which a user loses awareness from the local (real) environment and becomes convinced of his actual presence in the computer-mediated world. It may be thought of as a shift in attention or situation awareness from the local world of a user to the remote world of the teleoperated robot or virtual environment. During teleoperation there are some tasks to be completed and efficiency or safety may serve as explicit performance measures; telepresence is generally hypothesised to improve efficiency or reduce user workload in that application.

Schloerb (1995) contended that a person is objectively present in a remote environment where the person is not physically present, if there is some type of causal interaction between the person and the environment. For example, the person might cause or detect some remote event using a teleoperation system. Clearly, a person can also be objectively present in his or her local environment (where the person is physically present). In other words, telepresence is that a person is present in an environment that is physically remote from the person in space.

Hence, telepresence can be the control and management of a machine, equipment or process from a remote world. It is the experience of being present in a different environment from the environment in which the activity takes place. In education, telepresence can enable teachers to direct student’s work from a distance as if they were present, while students at a remote site can interact with telepresent teachers.
This effort is making telepresence accessible to more students. Students can communicate with the system through Internet or Intranet. They can submit tasks and learn the techniques of robot control. It is hoped that the design will change the current teaching process. The system can provide virtual and animated images on attributes of robot to support training. Students in the institute at any campus or in any location can acquire skills, various actions of the robot and access the information. This will enable delivery of knowledge be on-line and in real-time to achieve better result of education process.

The aim of this study is to investigate the quality of telepresence in teaching and learning. Areas to be focused on are outlined as follows:

Can the new technology enhance teaching and learning capacity?

A robotic interface has been designed to enable students to learn how to control a robot in a virtual environment instead of learning from a teacher. It is an interactive synchronous tools supporting teaching and learning via the Internet. Surveys were carried out and the objective is to compare the telepresence teaching in a virtual environment and the traditional teaching method in a real classroom.

The results would be most useful for the top management, and individual department. Teaching staff can consider delivering modules through telepresence mode.

2.0 Literature Review

Fels (2000) defined telepresence as the extent to which people feel immersed within a real or virtual situation even though they are not actually physically connected to it. Related to the way in which people experience the events and interpersonal interactions that take place in a remote location, over the past decade, telepresence has fulfilled a central role in a variety of educational and vocational applications. For example, we want a high level of telepresence to be experienced by users who manipulate remote objects such as astronauts and miners as well as those learning through distance of connected education.

There is considerable effort being made in the design and development of the telepresence robotic system (Tsang & Lee, 2000) (Tsang & Lau, 2000) (Tsang and Lee, 2000). Implementation of the telepresence robotic system has been carried out (Tsang 2006) in the Department of Engineering Management and Technology, Hong Kong Institute of Vocational Education (Chai Wan) . Attempt has been made to enable telepresence system accessible to staff and students as well as other people outside the campus. They can communicate with the system through the Internet or intranet. They submit tasks and verify their developed program by viewing the captured image. In other words, people located globally can acquire skills, learn various actions of the robot and access the information. This will enable the delivery of knowledge to be on-line and at real-time in a virtual environment to achieve better result of remote control process in a synchronous mode.

Traditional forms of distance education involve passive media such as correspondence texts, audio and video broadcasts, and often involve the learner communicating with only the instructor. Internet technologies can improve the traditional forms of distance education through increased communication (Shrum, 1988; McIsaac and Gunawardena, 2001 quoted in Boulton, 2002).

The distinctions between newer forms of distance education using Internet technologies and traditional face-to-face education are being blurred in the facilitation of individualised and collaborative learning. McIsaac and Gunawardena (2001 quoted in Boulton, 2002) stated that the explosion of information technology has brough learns together by erasing the boundaries of time and place for both site-based and distance learners.

The development of the Internet, and new cost-effective technologies has promoted an astounding growth of distance education courses. Provinces across Canada, including Saskatchewan, are implementing an infrastructure to increase bandwidth. High speed Internet access coupled with more sophisticated compression technologies will improve web-based distance education courses.

Saskatchewan Education’s Learning Technology initiatives of web-based distance education courses have enrolled many students throughout Saskatchewan. Traditional distance education courses of the industrial
era are slowly being eroded as the Internet and new technological developments challenge educators to re-conceptualise the idea of schooling and lifelong learning (McIsaac and Gunawardena, 2001 quoted in Boulton, 2002).

3.0 Methodology

The research questions attempt to explore why and how telepresence can be applied to replace traditional classroom. Its aim is to investigate the quality of telepresence education. The context of study “to investigate” the quality of telepresence teaching and learning clearly defines a specific case to be studied.

Researchers have used the case study research method for many years across a variety of disciplines. Social scientists, in particular, have made wide use of this qualitative research method to examine contemporary real-life situations and provide the basic for the application of ideas and extension of methods.

The research questions are used to explore the effect of traditional educational process replaced by telepresence and a deeper level of understanding the new approach of education. Therefore, case study is appropriate for exploratory research of this kind.

Three research instruments used were the questionnaire (quantitative), semi-structured interview (qualitative), and observation (qualitative/quantitative). They were designed to generate both the qualitative and quantitative data.

Quantitative research included survey using questionnaire. Qualitative research included in-dept semi-structured interviews and observations. All instruments namely the questionnaires, semi-structured interviews, and the observation details were available in English. A version of Chinese was also prepared for convenience of reference by somebody. The three research instruments were used in order to get a full and comprehensive picture of the students’ view on the quality of using telepresence for learning and teaching.

3.1 Questionnaire (quantitative),

The questionnaire covered the whole range of research questions related to student perception. The questionnaire was designed to look easy and attractive. Some space was provided for students’ comments as encouraging purpose. Wordings were clearly requesting students to “put a tick” in boxes. As the questionnaire survey was done in the class, no covering letter or posting was required.

3.2 Semi-structured interview (qualitative)

Semi-structured interview was used to interview two groups of students (total 25). Each student was asked to spend about 30 minutes to attend the interview. An interview guide was prepared and used to explore during each interview. It was used to ensure good use of limited interview time, making interviewing multiple subjects more systematic and comprehensive; and they helped to keep interactions focused. The set of questions can serve as a guide and has the possibility of generating reliable, accurate and valid data of the topics of interest.

The questions covered all those items related to the research questions. Although the questions were fixed items, which had the advantage of achieving greater uniformity of measurement, students could have freedom to talk about what was central significance to them. The semi-structured interview is flexible, adapted to the personality and circumstances of the students being interviewed.

The questions in the semi-structured interviews as mentioned above also contained common components which cross referenced with other instruments so as to gain deeper insight into the quantitative data.

3.3 Observation (qualitative)

Students in each group were randomly identified and observed in 20 minutes. Each observation was lasted for 1 minute and about 10 observations were scheduled. Area to be observed included (a) description of the situation; (b) behaviour of the students; (c) response of the students (d) personalities; (e) factors influencing their success and failure. Detail to be studies included on-task and off-task activities,
system management, use of the software to perform the remote control tasks, interaction with others and performing non-computer related tasks. The data were systematically recorded and subsequently analysed and interpreted.

To record the data qualitatively as mentioned, anecdotal records were used which were factual descriptions of the meaningful incidents and events. Each incident was written down shortly after it happened. The descriptions were recorded on the same page. Comments were also being written on anecdotal records. They recorded the actual behaviour displayed in natural situations (in the telepresence laboratory). They enabled gathering evidence on events that were exceptional but significant.

The above three research instruments were used. The notion behind these approaches is to overcome any inherent weaknesses of single measure instrument. It is to triangulate, to cross-reference with each other to achieve greater reliability, validity and a deeper level of understanding than would be possible with any one research instrument.

4.0 Research Finding and Analysis

All the research findings were carefully recorded, summarised, analysed based on the surveys to investigate the quality of telepresence in teaching and learning and to find out if the new technology (telepresence) can enhance teaching and learning capacity?

4.1 Student questionnaire
The questionnaire consists of 19 questions were designed with a five point scale from 1 to 5 (strongly disagree to strongly agree). The 25 students under the survey of questionnaire are studying Higher Diploma in Manufacturing Engineering, and Higher Diploma in Engineering Management.

The majority of students are neutral about the following:
(i) The practical approach helped me to learn (40%).
(ii) I can also ask questions through email in telepresence (48%).
(iii) I can also contact teachers during summer through telepresence (40%).
(iv) Telepresence learning developed my ability to solve problems (52%).
(v) It is better to have a teacher in the telepresence class as well (44%).
(vi) Overall, I would rate the telepresence teaching as good. (64%).

The following are the answers which were rated at scale 4 and 5 (strongly agree):
(i) The exercise of Internet (telepresence) are helpful. (64%).
(ii) The practical approach helped me to learn (52%).
(iii) Telepresence is useful for students who missed something in classroom (60%).
(iv) Telepresence online allows students to capture the missed lecture/parts anytime, and anywhere. (64%).
(v) More telepresence teaching in other subjects will be useful (44%).
(vi) In summer, I can enjoy the merits of telepresence at home (72%).
(vii) I can also contact teachers during summer through telepresence (52%).
(viii) Telepresence developed my skills in independent learning (60%).
(ix) It is convenient to raise questions in the classroom than telepresence (48%).
(x) Face to face discussions with teachers and classmates are more useful as we can have immediate response to discuss problems and solutions (72%).
(xi) It is better to have a teacher in the Internet telepresence class as well (52%).
(xii) Telepresence learning is interesting (68%).
(xiii) Telepresence can enhance learning flexibility (60%).
(xiv) I have a better learning attitude through telepresence (48%).

Feedback indicating considerable percentage of disagreement (rated at scale 2 and 1) are as follows:
(i) Explanations were clear and helpful to my learning. (24%).
(ii) I can also ask questions through email in Internet (telepresence) learning (24%).
(iii) Students tend to absent from class more frequently as they think they can study on their own using telepresence (32%).
4.2 Semi-structured interview
Similar question were asked and 20 students were interviewed. The following were the feedback:

(i) Can increase interactive approach.
(ii) Although telepresence is useful, teacher is still needed.
(iii) Very useful, more relax.
(iv) Use telepresence to complete assignment, convenient and fast.
(v) To some extent, students can contact teacher indirectly through email.
(vi) If there is telepresence, students will participate in more activities and more part-time job.
(vii) In the class, questions asked will immediately be answered, but not telepresence.
(viii) Answers given by teachers in classroom are more interactive and direct.
(ix) However, due to time limit, discussion in classroom was not in detail.
(x) Telepresence can only be used for supplementary teaching.

4.3 24 students were under observation of 4 observers and the following have been observed:

(i) More than 80 % of students have the actions:
   - Discuss with teachers
   - Discuss with classmate
   - Pay attention
   - Working online
   - Doing exercise
   50% of students asked questions.
(ii) 60% of students repeat reading.
(iii) 1 student (4%) of students seek technical support.
(iv) All students can proceed with the telepresence.

Remarks by observers include

(i) Starting to access was difficult.
(ii) Difficult to understanding the program as a start.
(iii) Most of the students were very attentive at viewing the telepresence.
(iv) Communication with teachers and students were frequent.
(v) Able to complete the tasks given.
(vi) The speed of the telepresence is fast and understandable.

5.0 Conclusions

Results of the survey (questionnaire, semi-structured interview, and observation) indicated that the quality of telepresence teaching and learning is comparable with conventional classroom teaching and learning. Most of the students are in favour of the telepresence learning due to its flexibility, convenience, and interactive. It can be accessed anywhere, any place, and anytime at ones own pace.

Some significant implications about the use of telepresence in teaching and learning is that telepresence online allows students to capture the missed lecture/parts anytime, and anywhere. Students believe that they can enjoy the merits of telepresence at home. They believe that telepresence can develop their skill in independent learning.

However, a large percentage (72%) of students indicated that face to face discussions with teachers and classmates are more useful as they can have immediate response to discuss problems and solutions.

The reason of using three survey methods is to overcome any weaknesses of single measuring instruments to achieve greater reliability and validity. Quantitative research using questionnaire is able to produce quantifiable findings in the form of quantified figures. Qualitative research using semi-structured interview yields descriptive information of greater depth of the problem. Observation was used in each incident to record the actual behaviour display in actual situation. They enable gathering data on events that are exceptional significant.
Triangulation between survey methods of the above research was using three approaches to the same study. Three sources of data collected are providing more accurate results and would be more reliable and valid.

References
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Author’s Background

Mr. Francis Tsang was graduated in the Hong Kong Polytechnic University. With his continuous study, he was further awarded the degree Master of Science in Engineering from the University of Hong Kong, Bachelor of Education from Australia and Master of Education from Leicester University in the United Kingdom. In addition, he was also awarded the Diploma in Management Studies from this University and Postgraduate Diploma in Computing from the Deakin University in Australia. In respect of his professional qualification, he is a Chartered Engineer and Professional Engineer in the UK and Australia respectively. Mr. Tsang is currently the Head, Department of Engineering Management and Technology in the Hong Kong Institute of Vocational Education (Chai Wan).