The Development and Evaluation of a Custom-built Synchronous Online Learning Environment for Tertiary Education in South Africa

A thesis submitted in partial fulfilment

of the requirements for the degree of

MASTER OF SCIENCE

of

RHODES UNIVERSITY

by

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December 2007

Abstract

The Departments of Computer Science and Information Systems at Rhodes University currently share certain honours-level (fourth year) course modules with students from the corresponding departments at the previously disadvantaged University of Fort Hare. These lectures are currently delivered using video-conferencing. This was found to present a number of problems including challenges in terms of implementing desired pedagogical approaches, inequitable learning experiences, student disengagement at the remote venue, and inflexibility of the video-conferencing system. In order to address these problems, various e-learning modes were investigated and synchronous e-learning were found to offer a number of advantages over asynchronous e-learning. Live Virtual Classrooms (LVCs) were identified as synchronous e-learning tools that support the pedagogical principles important to the two universities and to the broader context of South African tertiary education, and commercial LVC applications were investigated and evaluated. Informed by the results of this investigation a small, simple LVC was designed, developed and customised for use in a predominantly academic sphere and deployment in a South African tertiary educational context. Testing and evaluation of this solution was carried out and the results analysed in terms of the LVC's technical merits and the pedagogical value of the solution as experienced by students and lecturers/facilitators. An evaluation of this solution indicated that the LVC solves a number of the identified problems with video-conferencing and also provides a flexible/customisable/extensible solution that supports highly interactive, collaborative, learner-centred education. The custom LVC solution could be easily adapted to the specific needs of any tertiary educational institute in the country, and results may benefit other tertiary educational institutions involved in or dependant on distance learning.

Acknowledgements

My deepest thanks and appreciation go first and foremost to my supervisors, Professor Greg Foster and Brenda Mallinson. Your guidance, advice and enthusiasm have helped me immeasurably. Thank you also for your patient and tireless reading of drafts, and willingness to discuss and debate issues with me in many a long supervisory meeting. I am also most grateful to the Centre of Excellence in Distributed Multimedia at Rhodes University, Grahamstown, South Africa, for providing me with the finances and equipment necessary to complete this project.

Heartfelt thanks and much love also go to:

- My ever patient husband, Guy, for his help and encouragement, for listening to me in turn enthuse over and lament aspects of my progress over the past two years, and for cheerfully cooking dinners and making cups of tea to keep me going while I was writing up my thesis.
- My friends and family, who encouraged and supported me in person and over the phone, and particularly to David and Ings, who availed me of their home, pantry and electrical supply for days when a bad storm destroyed the electrical infrastructure in our neighbourhood.
- The denizens of #cognito on za24.zanet.net for your endless hugs, moral support, terrible puns, questionable synonyms, and generally being there in the background for me, cheering me on through good times and bad.

Opinions expressed and conclusions arrived at are those of the author and can not necessarily to be attributed to Rhodes University.

Declaration

I acknowledge that all references are accurately recorded and that, unless otherwise stated, all work herein is my own.

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Chapter 1 – Introduction to the Research

1.1 Introduction

This chapter situates the thesis in the general area of e-learning research, and explains the particular context in which the research takes place. The problem under investigation is then outlined and broken down into component sub-problems. The scope of the research is clarified, indicating constraints and delimitations on the investigation. The research methodology employed is then discussed, and is followed by a summary of the findings of the research. The last section of the chapter sets out how the report is organised with a view to clarifying its content and structure.

1.2 Research Context

E-learning, defined as any form of learning using computer and communications technology, is one of the fastest growing sectors of education and is becoming increasingly prominent in tertiary education (Vincent-Lancrin, 2005). The earliest incarnation thereof occurred in the 1970s with the introduction of Computer-Based Training (CBT) courses that made use of mainframe computers (Clark & Mayer, 2003: 20). These were very limited in their capacity, allowing users to select answers to multiple choice questions and then matching the results to pre-created feedback. As technology matured and diversified many new electronic devices were put to use in the service of learning, including audio and video tapes, teleconferencing, interactive TV and the World Wide Web (Hofmann, 2004: 2). The term e-learning is now most commonly used to refer to learning that is offered or facilitated at least in part over the Internet. Due to the tremendous accessibility of the Internet, e-learning has become a popular and effective way to provide distance learning solutions.

E-learning is considered to occur in one of two modes, asynchronous or synchronous. Asynchronous e-learning is largely self-directed and takes place in the learner's own time and at a place of their choosing (e.g. individually through the use of e-books or CD-ROM tutorials, or with others, interacting over email, online bulletin boards and discussion forums) (Hoffman, 2004: 9).

Asynchronous e-learning can be contrasted with synchronous (live) e-learning (Van Dam, 2004: 58), which involves two or more learners (and, commonly, a lecturer or facilitator of learning) communicating in real-time. Synchronous e-learning includes digital tools and content ranging from telephone calls and video-conferencing to Voice over Internet Protocol (VoIP), and video transmission over the Internet. Some synchronous e-learning tools like video-conferencing and Live Virtual Classrooms (LVCs) combine two or more synchronous technologies to create a solution that allows multiple channels of communication. Video-conferencing, for example, combines video and audio in an attempt to mimic the experience of interacting with others face-to-face, and is used both to facilitate meetings in business and industry, as well as for educational purposes. LVCs combine video and audio in a similar manner, but are designed specifically for web-conferencing, training, and education. They thus include a range of other tools intended to support interaction and distance learning, like collaborative whiteboards, surveying and polling tools, and participant feedback tools (discussed in detail in Chapter 5).

Video-conferencing is traditionally conducted over the public switched telephone network (PSTN), but can also take place over the Internet (Gibbs & Larson, 2007). It does not entirely free learners of the constraint of geographical location, due simply to the fact that video-conferencing equipment is expensive and so its infrastructure tends to belong to institutions rather than individuals. This equipment is thus usually located in specific video-conferencing venues to which participants must go in order to take part in a video-conferencing session. Internet video applications offer similarly rich, highly contextual audio-visual communication over distance, but differ in that the equipment they require (a desktop PC, webcam, microphone and a headset or speakers) is common and comparatively inexpensive (Reynolds, Mason, Carol, Eaton, & Odell, 2000: 935). These applications can thus be run from individuals' own PCs with minimal installation costs to the individual. They also differ from video-conferencing in that they frequently include functionality beyond that offered by traditional video-conferencing solutions; LVCs, for example, usually include video and audio but also offer a number of other tools to support communication and collaboration amongst users, as previously discussed.

A number of studies have been conducted on the use of video-conferencing in education. It is notable that video-conferencing is often used for lecture-style classes, in which information is transmitted largely or solely in one direction, from teacher to student. This is evident in a study by Gibbs & Larson (2007) which reports on the use of video-conferencing to broadcast classes to graduate students. These classes are considered of equal pedagogical value whether given live, archived and streamed off the Internet, or burned to a DVD. Hayden & Hanor (2002: 725 - 726) posit that, contrary to this trend in pedagogical practice, video-conferencing does support constructivist, collaborative learning. They acknowledge, however, that disengagement of remote learners is frequently a problem with the use of video-conferencing in education, and that the nature of the medium makes it difficult for facilitators of learning to even be aware that this is taking place. Other advocates of video-conferencing for use in education (Rogers & Jones, 1999: 188 - 191; Kunz, 2000: 1645 - 1647) also recommend the technology in such a manner as to acknowledge implicit problems of potential participant disengagement; Kunz correlates the use of video-conferencing in large classes with an increased inhibition to speak out, lowered spontaneity, and motivational problems amongst participants. These problems could be due to technical issues, such as problems with the transmission of audio and video reported by Kunz (2000: 1645 - 1647) and Gibbs & Larson (2007). They could also be attributed to Foreman's (2003) observation that video-conferencing fails to capture many of the visual cues relied upon in face-to-face interaction, which can not be conveyed in other ways or via other channels of communication in a video-conferenced class.

LVCs are a newer technology than video-conferencing and are used in both business and education, which may account for the fact that their use in education is not as well represented in the literature as that of video-conferencing. Reynolds *et al*. (2000: 935) investigate the use of LVCs as "an alternative or even a substitute for video-conferencing". Video-conferencing is recommended for straight lectures and seminars that do not require much interactivity, and LVCs are recommended for other educational uses. They also posit that LVCs have more potential as an educational tool than video-conferencing, are more flexible, and are more cost effective. Johansson, Stödberg, Johansson & Hedman (2005) report that the experience of using LVCs is initially similar to that of using video-conferencing in that a lack of visual

cues causes lecturers to compensate by adopting a more authoritarian style; however as lecturers learn to use the tools and the alternative channels of communication LVCs provide, teaching styles become more collaborative and interactivity increases. For small academic institutions the costs of LVC applications may still be prohibitive, but Foreman & Jenkins (2005) predict that increasingly available bandwidth will promote growth in the industry, driving costs down. It is possible for institutions that are unable to find a cost-effective or otherwise ideal LVC solution to implement their own, as Dokuz Eylül University did in their implementation of a virtual classroom solution blending aspects of video-conferencing and LVCs (Cakir & Basak, 2005: 1-5).

1.3 Research Motivation

Close ties exist between the Computer Science departments of Rhodes University and the University of Fort Hare (approximately 110km away). This is due to the twinning of the two departments through the Telkom Centre of Excellence initiative. As a result Fort Hare students have been participating synchronously in some of Rhodes University's honours courses (modules not offered at Fort Hare) since 1999, using the medium of video-conferencing to attend the classes remotely. Classes have averaged fifteen students, some of whom are always located in the same venue as the lecturer, whilst others attend remotely by the use of video-conferencing. This solution allows lectures to be delivered to both classes simultaneously. It also allows Fort Hare students to interact with the course lecturers in real time.

Using video-conferencing as a teaching and learning tool for Rhodes University and the University of Fort Hare (also referred to as the Universities), lecturers and learners noted that it presented a number of problems typical of those discussed above. They reported difficulties experienced by the remote learners ranging from seeing digital learning materials, to difficulties engaging these students in classes (further investigated and identified in Chapter 2) reflecting those reported by Kunz (2000: 1645 - 1647), except in a small rather than a large class scenario. These difficulties impacted on the quality of the learning experience being provided to remote learners in particular; they were not becoming involved in class discussion, were reluctant to ask questions, and were developing negative attitudes towards the classes, in contrast

to those learners geographically co-located with the lecturer and benefiting from face-to-face instruction. A number of lecturers and learners complained about the classes, but physical distance between the Universities made providing face-to-face instruction for all students impossible. If the remote learners from the University of Fort Hare were to continue to benefit from the opportunity to take courses only available at Rhodes University, an alternative e-learning solution was required to improve the facilitation of distance learning for the remote students. This research thus investigates alternative e-learning modes and tools that are appropriate for the dominant current pedagogical approach in South Africa.

1.4 Statement of the Problem

An investigation into problems with the existent video-conferencing solution, and the selection and implementation of an alternative e-learning solution to address these problems.

1.5 Statement of the Sub-problems

1. To investigate the video-conferencing solution in order to determine and clarify exactly what problems were being experienced by academic staff and learners.
2. To investigate alternative e-learning solutions that might address these problems. This would involve:
    a. An investigation of the asynchronous and synchronous delivery modes of e-learning in order to determine the merits of a live (synchronous) e-learning solution (e.g. LVCs) as compared to an asynchronous solution (e.g. the use of self-directed study modules, with interaction occurring over an online discussion forum).
    b. The establishment of a firm understanding of the pedagogical principles underlying the Universities' teaching practice, within the broader context of the National Education Policy. Any alternative e-learning solution would need to support these principles.
3. To select an appropriate type of alternative e-learning solution by means of:

   a. Investigating the available applications (proprietary and open-source if all these options were available) of the chosen type.
   b. Investigating the standard features and functionality present in these applications, and the value and appropriateness of these features and this functionality in the context of the Universities' pedagogical and practical (e.g. budgetary) needs and constraints.
   c. Developing a custom solution of the chosen type if a suitable solution was not found to be available.
4. To test, evaluate and critically analyse the chosen alternative e-learning solution in order to determine how successfully it addresses the current problems being experienced with the use of video-conferencing.

1.6 Scope of Research

The main focus of the research is on the use of synchronous e-learning tools, particularly LVCs, within the context of two specific small South African tertiary educational institutions.

Asynchronous e-learning tools are not considered as solutions, and the LVCs surveyed are a representative sample of those available rather than an exhaustive study. In the evaluation of the solution, in-depth investigation into the potential or actual pedagogical value of the medium itself is not carried out.

The research concentrates on the use of LVCs for small, interactive academic groups in a tertiary educational environment. The use of LVCs for large groups (e.g. for large public webcast lectures), or in different environments (e.g. for use in industrial and corporate training), will not be explored.

Although the research could be applicable to South African educational institutions of other kinds (e.g. much larger tertiary educational institutions or colleges) or at other levels (e.g. secondary education), these are considered beyond the scope of this particular study, as are tertiary educational institutions internationally.

1.7 Research Methodology

This research makes use of the qualitative and quantitative research methodologies. It begins with a process of informal qualitative interviews which are used to inform the development of formal questionnaires. These are used to gather mostly quantitative (Likert type questions) but also some qualitative (free form) data about the problems in existence with the current video-conferencing tool used as a distance learning solution for the Universities. The data gathered from the questionnaires is analysed to develop a comprehensive understanding of the problems experienced with the use of video-conferencing, and to confirm the need for an alternative e-learning tool that would address these problems.

A literature study is then conducted which initially explores e-learning modes. These are critically analysed to determine their advantages and disadvantages, in order to inform the selection of a particular mode for use by the Universities. The literature study then investigates common pedagogical approaches to teaching and learning, which are once again analysed in terms of their advantages and disadvantages, and considered with particular reference to the context of the South African national education environment.

The findings of the literature survey are used to inform a survey of existing LVC applications. The applications are considered in terms of the features they offer, with particular reference to the appropriateness of each of these features for inclusion in an e-learning tool to facilitate distance learning in the Universities tertiary educational context.

No available LVC application is found to be ideal for the Universities, and so a custom LVC application is developed for the Universities' use. The custom application is then tested and evaluated. Qualitative data is gathered from test participants by means of a survey (adapted from the survey originally developed to investigate the video-conferencing tool). This data is empirically analysed to determine the appropriateness of the custom solution to the Universities' pedagogical needs, and the extent to which it meets the goals formulated from the initial analysis of the problems experienced with the current video-conferencing solution.

1.8 Summary of the Findings

Synchronous e-learning was found to be the most appropriate mode of e-learning for the Universities' needs, and LVCs were selected as the most appropriate synchronous e-learning tool. Available LVC solutions were not ideal and so a custom LVC was developed and implemented. Evaluation of the custom LVC yielded results that indicated that it provided the software features to support the teaching and learning principles envisioned for the facilitation of e-learning over distance, and addressed the majority of problems that had been experienced with the use of video-conferencing. The custom LVC was found to be technically sound, and improvements in the design of some of its components were easily addressed as the solution is flexible and customisable. The solution itself did not address learner behavioural or attitude problems, and if these were to occur they would need to be dealt with by the lecturer or facilitator overseeing a particular distance learning class.

1.9 Thesis Organisation

This thesis is organised into several chapters. The first is intended as an introduction to the work, contextualising and explaining the problem to be solved. Chapter 2 investigates this problem in greater detail, and establishes the need for an alternative e-learning solution. Chapter 3 examines the advantages and disadvantages of the modes (synchronous or asynchronous) in which e-learning solutions are available, and establishes that a synchronous solution would be preferable. LVCs are identified as one such solution, but their pedagogical suitability remains unknown. Chapter 4 establishes the pedagogical framework that any acceptable solution would need to support, and deems LVCs to be worthy of further investigation in this regard. Chapter 5 investigates available LVC solutions and indicates that, for a number of reasons detailed in the body of the chapter, none of the available solutions is ideally suited to solving the problem identified in section 1.4 of this chapter. Chapter 6 thus proposes a custom Live Virtual Classroom solution to the problem, and details how this is designed and implemented. The custom solution is tested and evaluated in Chapter 7, and is concluded to offer an appropriate and powerful alternative to the video-conferencing system, solving a number of the problems identified with video-

conferencing. The final chapter (Chapter 9) outlines possible extensions to the custom solution, and possible future work suggested by the findings of this thesis.

1.10 Conclusion

This chapter provided an introduction to the thesis, and placed the work in context. The research problem and sub-problems were outlined and the scope of the research delimited. The research methodology was detailed, and a short summary of the findings of the thesis were provided. Finally the organisation of the thesis was indicated as a high-level guide to the work.

Chapter 2 – Current Status

2.1 Introduction

Video-conferencing has been used to share certain Computer Science and Information Systems honours modules between the University of Fort Hare and Rhodes University since 1999. Each institution has a lecture venue in which video-conferencing equipment (PolyCom ViewStation FXs supporting H.320 over ISDN) is installed. Classes assemble at each venue, with a facilitator present at one of the venues. The class given to participants co-located with the facilitator is then shared with participants at the other venue, referred to as the remote venue. Different facilitators run their courses in different ways and their approaches include:

- A very traditional instructional lecturing style combined with facilitation from a single location for the duration of the course.
- Moving participants from their usual location (remote or co-located) to the other, to vary their experiences and introduce them to participants from the other group.
- Travelling to the remote location so as to give each class the experience of being both co-located and remote.
- Rotating a small number of participants from the remote group into the co-located group, varying the participants on a weekly basis.
- Involving participants in using the video-conferencing technology and running the video-conferencing sessions.
- Using the video-conferencing technology and running the video-conferencing sessions all themselves.

These approaches have met with varying degrees of success and popularity, but almost all have incurred challenges and difficulties which gradually began to call into question whether video-conferencing was the ideal solution for shared tertiary teaching and learning.

The issue became more urgent as the Universities' pedagogical approaches shifted in line with changes to National Education Policy (detailed in section 4.3 of Chapter 4). Head, Lockee & Oliver (2002: 261) identify three variables in the design and delivery

of distance education, namely 1) Method of teaching, 2) Media attributes and 3) delivery Mode (the three Ms). Teaching method (pedagogical approach) should determine what media or learning content is developed, and this in turn should determine the mode of delivery and the technology used in this mode. At Rhodes University and the University of Fort Hare the method of teaching that was used began to change in favour of more learner-centred and interactive approaches. This meant that not only did facilitators begin to require different things for shared tertiary classes, but the way they taught and the associated learning content shifted. Although delivery mode is not the primary factor impacting whether or not learning takes place (Lockee, 2001; Head *et al.*, 2002: 265), it is vital that the chosen delivery mode support whatever method of teaching is in use and the media attributes of the associated learning content. It became increasingly clear that video-conferencing was not offering enough of this sort of support, prompting further investigation into the problem.

2.2 Aims and Methodology

In order to understand and clarify the nature of the challenges and difficulties experienced, and to confirm that they were perceived to present a significant problem, informal[1] preliminary interviews were held with video-conferencing course facilitators and participants. Their concerns were noted to fall into a number of categories, namely 1) opinions and attitudes about video-conferencing, 2) participants' feelings about facilitation and the role of the facilitator in the video-conferencing class (and vice versa) and 3) technical issues.

A questionnaire was designed to gather data on the concerns identified from the informal interviews. It was structured using the aforementioned categories and included an initial category to gather profile data from respondents. The questions were grouped and ordered slightly differently for facilitators (Appendix A) and participants (Appendix B), appropriate to their different perspectives. Facilitators answered three extra questions addressing the impact of the video-conferencing technology on their teaching. Three of the profile questions required respondents to

[1] Interviews were not recorded and interviewees were encouraged to speak freely around the broad topic of challenges and difficulties that they had experienced with the video-conferencing system.

tick boxes appropriate to their demographic data (e.g. indicating the decade in which they were born), and the final question on both versions of the questionnaire allowed for free responses. All other questions were structured as statements and used a four-point Likert scale (Trochim, 2006), requiring participants to rank their degree of agreement or disagreement by circling numbers. The scale had an even number of options to prevent participants from choosing the middle option, forcing them not to remain neutral on any of the Likert items (Uebersax, 2006).

2.2.1 Demographics

The majority of participant respondents (82%) were born in the 1980s, whereas the majority of facilitator respondents (67%) were born in the 1950s.

Of the six facilitator respondents, all were professional Computer Science lecturers. Racially (employing the categories used in the 2001 population census by the Policy Co-ordination and Advisory Services of the South African Government (2006)) all of the participants were “White” and middle class. Only two of the six facilitators were female. More diversity in terms of race, class and gender was precluded by the fact that the distribution of questionnaires was limited to facilitators who had had experience using the video-conferencing system for distance education.

Of the eleven participant respondents, seven were Computer Science Masters students and four were working IT professionals. Racially (employing the categories used in the 2001 population census by the Policy Co-ordination and Advisory Services of the South African Government (2006)) five of the participants were “White”, and six were “Black African”. Six participants were middle class and five came from an economically disadvantaged background. Only two of the eleven participants were female. More diversity in terms gender was precluded by the fact that a number of potential female respondents did not return the questionnaire.

Seventy-six percent of respondents took part in courses of fifteen days or longer. All met frequently (either daily or a few times weekly), and more than 75% of the respondents were involved with groups of over eleven participants.

2.2.2 Limitations

Females, people of colour, and economically disadvantaged participants were underrepresented in the sample group of facilitators, and females were underrepresented in the sample group of participants.

2.3 Questionnaire Results and Discussion

The questionnaire was circulated to eight past and present video-conferencing facilitators and sixteen participants, with a total return rate of 75% (six (33%) of which were returns from facilitators, and eleven (61%) of which were returns from participants). Results are documented in Appendix C.

2.3.1 Experience

Seventy-three percent of participants rated themselves as experienced or very experienced in participating in a video-conferencing class, although their impressions of how prepared they were for participation were evenly divided. Only 33% of facilitators rated themselves as experienced, and facilitators uniformly rated themselves as not having had extensive training in facilitating synchronous e-learning classes. Eighty-three percent of both facilitators and participants indicated that they felt that e-learning facilitation required special skills, and that it is important for facilitators to have practice in the use of the video-conferencing technology. The participants felt more strongly than the facilitators that such practice was necessary, perhaps indicating a degree of over-confidence on the part of the facilitators. Facilitators were divided as to whether participants needed practice in the use of the video-conferencing technology (50% voting for this, and 50% against). This could be explained by reference to the degree to which facilitators chose to allow participants to play an active role in controlling the technology. Participants themselves felt it relatively valuable that they get the opportunity to practice using the technology; 64% strongly agreed that this should be the case, while only 18% strongly disagreed. This demonstrated either an enthusiasm for learning a new technology or a lower degree of confidence in using the video-conferencing technology than facilitators believed them to possess.

2.3.2 Interactivity and Engagement

Participant opinion was divided as to whether their class experiences had been interactive; 45% felt that they had been, but 55% felt that they had not. Sixty-seven percent of facilitators did not think that the level of interactivity in their classes was good. The majority of participants (82%) perceived facilitators as approving of interactivity levels, although only 50% of facilitators in fact did so. Not all facilitators felt that a lack of interactivity was a negative factor; one respondent commented, "A relevant case study would be Open University in the UK. They use video tapes rather than video-conferencing. I wonder why? Perhaps video-conferencing is best for just that – conferencing, not learning." This facilitator's instructor-centred (section 4.2.1 of Chapter 4) teaching style was described as "intimidating and unnecessarily formal" by a participant. The same facilitator disagreed that e-learning facilitation required special skills, perhaps indicating that they were out of touch with participants to a certain extent. In contrast to this example, another facilitator commented that interactivity was vital to their course, and that the diversity of the two groups of learners aided them in facilitating the course due to the nature and content thereof. This respondent focussed on learner-centred facilitation as opposed to lecturing, and planned sessions to be very discursive, prioritising establishing relationships with and between participants that would encourage interactivity at every opportunity.

2.3.3 Learning Pace

Most participants (73%) felt in control of their learning, although 83% of facilitators perceived them as not feeling in control. Sixty-seven percent of facilitators felt that the remote and co-located groups did not maintain the same pace of learning, and no facilitator felt strongly that they did. Participants felt even more strongly that learning pace was an issue; 73% indicated that they believed the same pace of learning was not maintained at the different locations.

2.3.4 Anonymity and Inequitable Learning Experiences

Eighty-eight percent of respondents disagreed that facilitators had been able to devote equal attention to both the remote and the co-located groups. Most participants (55%) perceived facilitators as having been somewhat unaware of the remote group. Only

33% of facilitators felt this to be true, however not a single respondent (participant or facilitator) rated awareness of the remote group as good. Both facilitators (83%) and participants (73%) considered remote group learners to be relatively anonymous in comparison to co-located group learners, but more participants felt this strongly (i.e. giving a Likert item ranking of four) than facilitators. Seventy-three percent of participants and 83% of facilitators felt that the use of another facilitator at the remote site was a good idea. Both participants (55%) and facilitators (67%) indicated a belief that existing variations in the learning contexts of the two groups of participants were highlighted by the video-conferencing technology, although this belief was clearly stronger amongst facilitators. Participants generally reported that they felt involved in the class (73%), and could concentrate (73%), despite the majority of facilitators (67%) indicating concern that learners had experienced concentration difficulties.

2.3.5 Relationship between Facilitators and Participants

A small majority (55%) of participants disagreed that facilitators connected positively with them, while facilitators' own impressions on the topic were evenly distributed (50% agreeing that there had been a positive connection, and 50% disagreeing).

2.3.6 Relationship between Participant Groups

With respect to the relationship between the two groups of learners, most facilitators (83%) and participants (91%) strongly disagreed that the remote and co-located groups of participants connected and interacted positively. One participant whose entire video-conferencing experience took place in the co-located group commented, "Often when you are on the same side as the facilitator you tend to ignore the remote class 'cos they are like flies on the wall or just other people watching you. So you don't really care about them and forget they are even there." This unfortunately seems an accurate reflection of the perceived dynamic between the two groups in the majority of video-conferencing classes that were held. Such sentiments were not limited to co-located participants; 64%, irrespective of whether they were in the remote or the co-located group, indicated that they felt distanced from peers in the other group. Distance from peers was more of a problem for participants than distance from the facilitator. Facilitators' opinions reflected this too; 100% of facilitators

indicated that participants disconnection from peers was a problem, but only 50% felt that participants were distanced from them.

2.3.7 Pre-course Face-to-face Meetings

Pre-course face-to-face meetings were strongly considered by both facilitators (67%) and participants (73%) to contribute to a more positive class dynamic. They were generally perceived as benefiting both groups equally, although 36% of respondents felt that they mostly benefited the remote group. One participant commented that although their class had not had any such meetings they would make a lot of sense as their group would have tried harder to understand the other participants if they had not been “just [people] inside a TV”.

2.3.8 Transmission Quality and Clarity

Responses were very evenly distributed across the spectrum of opinion with respect to the clarity and readability of learning materials amongst both participants and facilitators. Both participants and facilitators agreed that video clarity and quality were high, but ranked audio clarity and quality somewhat lower. Audio and video were considered well synchronised based on the Likert item responses but a participant commented in the free responses section that “the voice usually was not synchronous with the video” so this must have been a problem in at least some of the video-conferencing classes.

2.3.9 The Respective Importance of Transmission Elements

Eighty-two percent of respondents thought it was impossible to see important elements (i.e. facilitators, learning materials and participants) simultaneously. Facilitators rated all three elements as highly important for video transmission, with a slight emphasis on the importance of the facilitator. Participants focussed on the importance of materials and rated participants (themselves and others) as the least important element. The fact that they did not consider being able to see their peers in the remote group as important, reinforces the hypothesis that relationships between participants in the two groups were poor. It also suggests that participants understand

the learning process as one in which content (the most important thing) is transmitted to them by a learning expert, the facilitator (the next important thing). This process is one in which the peers do not play a meaningful role; learning is instructor-centred and not collaborative (section 4.2 of Chapter 4). Most participants thus seemed to be unfamiliar with the core principles and practices of learner-centred, constructivist, collaborative teaching and learning, in which participants and their peers are a vital part of the learning process.

2.3.10 Perceptions of the Video-conferencing Environment

Most facilitators (67%) and a strong majority of participants (82%) disagreed that they found the video-conferencing environment intimidating. Their impressions of one another's attitudes in this respect were relatively accurate; 83% of facilitators felt that participants had not found the environment intimidating, and 55% of participants indicated that facilitators had not found the environment intimidating. Only 36% of participants found the video-conferencing environment to be a distracter, making participants more accepting of the environment than facilitators, 50% of whom found it a distracter. Facilitators, however, had to manage the environment rather than just learn within it, and would thus have had an understandably more challenging experience than participants.

2.3.11 Perceptions of the Video-conferencing Technology

Eighty-two percent of participants believed total control over the camera was possible, but 67% of facilitators did not feel that they had this control. All but one of the facilitators thought that the elements of the video-conferencing system could be manipulated to customise the learning environment (physically), but were divided in their opinions as to whether the system could be easily upgraded to incorporate new technologies or features, half believing that this was possible and half disagreeing.

Most respondents (82%) considered the video-conferencing equipment straight-forward to use. Despite this, 82% of participants and 100% of the facilitators disagreed that the technology allowed participants to take part in the classes without difficulty, and questioned its reliability. Neither participants nor facilitators believed

that the video-conferencing technology allowed complete control over the entire class, and 83% of facilitators did not feel that the video-conferencing system was adequate for their teaching needs. The video-conferencing technology was seen to render non-verbal communication, such as making eye contact and reading facial expressions and body language, either impossible or significantly difficult. Thirty-six percent of participants and 67% of facilitators felt that the video-conferencing technology was a determining factor in the creation of the distance they felt between themselves and the other group, be it remote or co-located.

2.3.12 Overall Impressions

Approximately half of the facilitators indicated that before the course they were very enthusiastic about the opportunity to facilitate a course using the medium of video-conferencing, and afterwards 67% of facilitators said that they has been pleased and positive about having had the video-conferencing experience. Participants did not detect a clear enthusiasm from facilitators about the medium; 50% of participants felt that facilitators were enthusiastic, while the other 50% felt they were not. Participants' pre-course enthusiasm for participating in a video-conferencing course was evenly distributed and demonstrated no clear trend, with 27% of participants indicating a strong lack of enthusiasm, 27% indicating a mild lack of enthusiasm, 27% indicating mild enthusiasm and 19% indicating strong enthusiasm. Subsequent to the course, participants' opinions with respect to whether they would want to take another course using video-conferencing technology demonstrated a similar distribution pattern. Fifty-five percent of participants were negative about video-conferencing and the rest remained positive. However, this time only two participants ranked their feelings as "strong". Responses from participants were not dependent on their membership in a particular learning group (local or remote), and despite the similarity in distribution of overall positive and negative responses, more than half of the respondents changed their rankings from their initial predictions.

Eighty-three percent of facilitators felt that video-conferencing was not an effective learning solution, although it fulfilled a need for shared tertiary instruction. A facilitator remarked that for all its problems, video-conferencing was a "giant leap forward… in comparison to hours of travelling". Participants' Likert item responses

indicated that most respondents (73%) disagreed that video-conferencing was this ineffective, although one participant (whose entire video-conferencing experience had been in the remote group) commented in the free response section that in their opinion, "…video-conferencing should not be used for teaching classes. The remote-based students do not have equivalent interaction to those who are on site with the lecturer."

2.3.13 Perceptual Differences

Differences exist between facilitators' and participants' responses to questions about their perceptions of one another (with respect to enthusiasm levels, attitudes to interactivity, feelings about their learning, and their awareness of the remote group). These differences indicate discrepancies between facilitators' and participants' impressions/experiences of the same events, suggesting a lack of understanding of or empathy with one another's perspectives and points of view.

2.4 Conclusion

The data, gathered from the preliminary informal interviews and the questionnaires, indicated that the video-conferencing system led to inequalities between the two participant groups. The remote group was prejudiced, outpaced by the co-located group and comparatively anonymous, marginalised, and frequently disengaged from the class. The technology impacted negatively on the establishment of relationships within the classes, to a certain extent between the facilitator and the participants, but particularly between participants. Participants responded well to more interactive classes, but facilitators found creating these sorts of classes challenging, particularly given the constraints of the technology and the learning situation it necessitated. Participants were keen to be more involved in using learning technology, and did not find this technology too intimidating. Technical problems with the ease of transmission and clarity of learning materials, and the synchronisation of voice and video, further complicated existing problems. This lead to a majority belief amongst facilitators that video-conferencing was inflexible and an inadequate teaching and learning tool.

All of this suggested that an alternative e-learning solution was required for shared tertiary education. Any alternative would have to ensure that no particular group of participants was prejudiced, outpaced or made to feel disengaged or anonymous. It would have to make the transmission of digital learning materials clearer, be relatively simple to use, and not present problems with audio and video synchronisation. It would need to support highly interactive, engaging, learner-centred education (see the discussion of pedagogical requirements in Chapter 4), be suitable for small academic group use, and be flexible/customisable/extensible to respond to the changing needs of the Universities and their students. As such the choice of alternative e-learning tools was constrained more by pedagogical needs than by technological needs, any e-learning tool that was pedagogically suitable could be considered. This necessitated an examination of the available modes of e-learning (Chapter 3) in order to guide the selection of a suitable tool. Once such a tool had been identified it would need to be investigated further to determine its suitability (Chapter 5).

Chapter 3 – E-learning Modes

3.1 Introduction

To begin considering alternative e-learning tools, it is first necessary to understand the modes in which e-learning takes place and which are often used to categorise such tools. E-learning, sometimes referred to as virtual learning, can be divided conceptually into asynchronous and synchronous teaching and learning environments and methods. When these concepts are examined it becomes clear that there is no standardised meaning for many of the terms used. Horton (2000: 55) accurately observes that the terms synchronous or asynchronous cause more confusion than any others. This confusion tends to err in favour of the more established mode, asynchronous e-learning; Chen, Ko, Kinshuk & Lin (2005: 182) observe that the majority of research currently described in the literature has focussed on the asynchronous mode of e-learning. Comparatively little research exists on the issues related to online synchronous learning.

Not only does research in e-learning focus on asynchronous teaching and learning, but unsupported assumptions are rife. Concerning synchronous e-learning, Balbar & Schwier (2002: 55) intend to address the values and limitations of synchronous communications in general in higher education, but only assess a synchronous text-based chat application. Many of their assertions regarding synchronous communications in general, based on this research, are valid and insightful. They do, however, make some generalisations about synchronous communications which, although arguably accurate with regard to text chat, are inaccurate if applied to the entire field of synchronous e-learning; for example, the assertion that synchronous communications are too fragmented to promote the depth of discussion required to address complex issues.

Similarly, Palloff & Pratt (2001a: 7) make the same assumption that chat is totally representative of synchronous communications when they suggest that synchronous or ‘chat’ sessions be used to supplement asynchronous discussions, using the terms interchangeably.

Salmon (2000:18) refers to the "asynchronous nature" of Computer Mediated Communications when commenting on Computer Mediated Communications, an observation which was fairly accurate in 2000 although audio and visual aspects were under development. Despite changing technologies the association of the asynchronous mode of delivery with the broader concept of e-learning seems to have persisted, and forms the basis of the common assumption that e-learning over the Internet is, by nature, fundamentally asynchronous. Jolliffe, Ritter & Stevens (2001: 9 -10) make similar assumptions, although they do address the difficulty of giving a precise definition to Web-based learning. They acknowledge that learning environments can be synchronous or asynchronous, but then go on to use the term "Web-based learning" to refer exclusively to asynchronous e-learning.

Andrews & Klease (2003: 2), in investigating the establishment of a "virtual faculty", state that video-conferencing (a synchronous technology) makes in-depth, real-time exploration of difficult concepts possible. They go on to say that this degree and quality of exploration would be extremely difficult over the Web. The implication is that the Web does not allow for synchronous, complex e-learning interactions, which could make sense if interpreted as a technical reference to the use of HTTP (the Hyper Text Markup Protocol) as a protocol; however there is nothing in the article to indicate this. The assertion suggests a lack of knowledge of the functionality of live virtual classroom applications available at the time of writing (2003), such as HP's Virtual Classroom. Furthermore, in the consideration of blended e-learning marrying synchronous and asynchronous e-learning modes, an assessment of the strengths and weaknesses of various learning technologies assumes Internet-based technologies to be asynchronous (Mantyla, 2001: 108).

A closer examination of the asynchronous and synchronous teaching and learning environments and methods is considered valuable in clarifying the meanings of the terms and identifying the advantages and disadvantages associated with the use of each e-learning mode.

3.2 Asynchronous E-Learning

Asynchronous e-learning refers to teaching and learning that occurs independently of geographical or time constraints. Participants can engage with the same material at different times and locations, carrying out their activities in their own time. If there is a facilitator involved, he/she can initiate the activity; if not, it can be self-directed. Hoffman (2004: 9) gives examples of this self-managed or self-paced learning, including learning elements such as e-books, moderated discussion boards, CD-ROM tutorials, video/audio tapes, discussions and Q & A mentoring. In any communication the delay between sending messages and receiving feedback is defined as the level of immediacy of the communication (Feyton & Nutta, 1999: 75). When the level of immediacy is so high as to make the delay level negligible, the communication is usually referred to as synchronous (see section 3.3 of this chapter). This distinction is made based on the category of communication rather than a particular instance of communication; thus, although it is possible to send an email and receive a reply almost instantaneously, and equally possible to send an instant text message and receive a reply a few minutes later (e.g. if the intended recipient was away from their desk at the time of sending), email is considered an asynchronous communication technology while instant messaging is considered a synchronous communication technology.

3.2.1 Asynchronous Learning Networks

Jolliffe *et al.* (2001: 9) define an asynchronous learning network as being made up of people using a computer to carry out and manage their communications, communicating at diverse times and locations. Such networks leverage software applications like whiteboards, email systems and discussion boards, that participants can use to post messages, read messages or respond to messages all within the same shared space. Notice boards and discussion forums form an important part of these networks as do Frequently Asked Question (FAQ) sections that offer answers and solutions to common questions and problems.

3.2.2 Advantages of Asynchronous E-Learning

In discussing the advantages of *synchronous* e-learning, Chen *et al.* (2005: 183) organise their assessment into three major categories: instructional, logistical and

economic. Their logical classification system will be used in this report in assessing both the asynchronous and synchronous modes of e-learning.

3.2.2.1 Instructional Advantages of Asynchronous E-Learning

Asynchronous e-learning is also called self-paced e-learning and this is one of its advantages. The fact that learners can participate at their own convenience and at a pace that is appropriate for their individual learning style (Hoffman, 2004: 9) means the slower learners do not get left behind or ever feel themselves to be underachievers compared to their faster peers. Horton (2000: 55) suggests that this mode of e-learning also helps to ensure that learners have the anonymity and privacy which contribute to the creation of an equitable learning experience for all. Morse (2003: 38) proposes that relative to either face-to-face or synchronous environments, the asynchronous learning environment has the benefit of preventing undesirable classroom behaviours such as learners bidding to speak, interrupting one another's contributions, and dominating or attempting to dominate the discussion.

Asynchronous e-learning is ideal for problem-based learning in which a problem and some suggested resources are provided for learners as a starting point for learning, allowing them to investigate the problem in their own time (Jollife *et al.* 2001: 11). This type of exercise encourages learners to create their own understanding of a problem and integrate the material they are learning into their existing mental models. Working alone also encourages participants to be independent learners and to develop self-reliance, an important life skill (Horton, 2000: 55). Group learning can take place (e.g. with students interacting via email or on discussion boards), and is facilitated by the fact that group members can work together despite differing schedules (Henry, 2004).

Learners for whom the asynchronous course or lesson is conducted in a second language, report that the medium helps to break through language barriers, allowing them to study the contributions of others offline (leading to increased understanding), and giving them the time to refine and perfect their own contributions in order to ensure that the content and meaning are as intended (Morse, 2003: 47 - 49).

3.2.2.2 Logistical Advantages of Asynchronous E-Learning

Asynchronous e-learning offers students flexibility with respect to place and time of learning as well as with respect to their level of participation (Horton, 2000: 55). They do not have to conform to the instructors' personal schedule and this flexibility makes asynchronous e-learning accessible to many learners who would otherwise have been excluded, such as learners who are already working full or part time, or those in a time-zone that differs significantly from that in which the course is scheduled.

3.2.2.3 Economic Advantages of Asynchronous E-Learning

Asynchronous e-learning can be less expensive than face-to-face or synchronous classes as, depending on the design and structure of the course, there can be less need for an instructor. When an instructor or facilitator is necessary, the time necessary to be devoted to an asynchronous e-learning course varies depending on how involved they are in communicating with participants (Horton, 2000: 55). Although asynchronous e-learning can be cheaper to implement (e.g. when there is no need to hire an instructor or rent a venue, and content is easily converted into a suitable format for asynchronous e-learning), developing entirely new content is generally more expensive than for face-to-face or synchronous e-learning (Horton, 2000: 52).

3.2.3 Disadvantages of Asynchronous E-Learning

Asynchronous e-learning has a number of disadvantages compared to both synchronous e-learning and traditional face-to-face learning.

3.2.3.1 Instructional Disadvantages of Asynchronous E-Learning

Asynchronous e-learning necessitates a loss of real-time interaction. This may be irreplaceable for some learners who understand concepts better through direct face-to-face interaction with another person (Bean, 2005: 2). For many learners the limiting factor in asynchronous e-learning is the lack of non-verbal cues which can make interpreting one another's moods, tones, meanings and intentions extremely challenging (Balbar & Schwier, 2002: 59).

Self-paced learning is often difficult for students as it requires a high degree of self-discipline and self-direction. Motivation thus becomes a problem, and this is even more likely to be the case if an asynchronous lesson or course is without deadlines and deliverables (Hoffman, 2004: 9). Decreased motivation impacts directly on the extent to which learners are willing to invest the mental energy and hard work necessary to achieve meaningful learning (Feyton & Nutta, 1999: 70), and can lead to a high drop-out rate from asynchronous e-learning courses. Motivational problems are also exacerbated by frustration caused by the lack of a live facilitator or trainer of whom to ask questions (Hoffman, 2004: 9). Riedling (1999: 9) identifies timely feedback to learners as fundamental to the effectiveness of any distance education program. Since asynchronous communication does not take place in real time, timely feedback to learners' questions and comments (both from the facilitator and from other participants) can be problematic.

There is often very little, and sometimes no, direct interaction amongst learners and between learners and facilitators in asynchronous e-learning, preventing students from socially negotiating meaning with their peers or using this interaction to direct the creation of personal information structures (Parker, 1999: 14). Porto (2005) notes that many students report feeling lonely and isolated in purely asynchronous online e-learning courses due to the lack of immediate social interactions typically found in face-to-face instructional settings. Horton (2000: 36-37) agrees with Porto (2005) and warns that learning alone can seem cold and sterile to participants when human contact is lost. This isolation can in turn be a source of tremendous frustration for learners who find themselves left largely to their own devices to solve problems (Barclay, 2001: 7). Similarly, Czerniewicz (2001: 17 - 21) identifies isolation as the defining characteristic of her asynchronous e-learning experiences, and argues that true collaborative learning is impossible in this condition as learners feel alienated, both from other learners and from the learning process.

Asynchronous e-learning can involve computer assessment of tasks (although this is not a necessary characteristic of this mode of e-learning), due to the fact that this further removes the need for an instructor. Automated computer assessment has been criticised as encouraging rote learning of facts which are memorised and then fed back to the computerised assessment system, an approach which fails to promote

critical or independent thinking (Chambers, 1999: 7). Asynchronous e-learning courses can often be run quite competently by a moderator (section 4.6 of Chapter 4).

3.2.3.2 Logistical Disadvantages of Asynchronous E-Learning

Where there is an instructor or facilitator for an asynchronous e-learning course this person can theoretically be contacted 24 hours a day by email. Practically, however, asynchronous e-learning instructors are usually working on more than one course at a time, and often have to deal with a large volume of correspondence. When replies are slow, students can become discouraged (Riedling, 1999: 9). In order to reply relatively quickly the instructor has to be online almost constantly, making for a very long working day. According to Horton (2000: 34), many teachers and facilitators find that students demand more attention and feedback from them when lacking face-to-face contact, expecting them to be effectively private tutors. As a result, teachers and facilitators feel themselves to be under increased pressure with regard to the amount of effort and time required of them to organise and run asynchronous courses.

Asynchronous e-learning can be more time consuming for students than synchronous or face-to-face learning, as all communication with others is dependant on written communication methods (such as emails or discussion board posts). This reliance on writing can negatively impact participants whose typing skills, written language skills and interpretation skills are weak (Morse, 2003: 39 - 40). Compared with face-to-face or synchronous e-learning, asynchronous e-learning lacks aural and visual cues such as tone of voice, facial expressions and body language that make up an important component of what is communicated in face-to-face interactions. As these cues help us to determine others' level of interest and engagement in what we are saying, their absence can increase misunderstandings (Horton, 2000: 35). The reduced level of visual and aural cues in asynchronous e-learning is considered a significant disadvantage (Henry, 2004).

3.2.3.3 Economic Disadvantages of Asynchronous E-Learning

Asynchronous e-learning can be costly in terms of the expense either of converting traditional face-to-face content and methods into text-based content for use on the

web or on CD or DVD ROMs, or developing new content and multimedia resources. Feyton & Nutta (1999: 20) describe this as a hidden cost of virtual learning and instruction.

3.3 Synchronous E-Learning

Synchronous e-learning, also called live e-learning (Van Dam, 2004: 58) or real-time e-learning (Feyton & Nutta, 1999: 74), involves direct, real-time communication between participants (e.g. amongst students, or between students and facilitators or lecturers) using Information and Communication Technologies (ICTs). Synchronous e-learning includes technologies like telephone calls, VoIP, live text chat, video-conferencing, and LVCs.

3.3.1 Advantages of Synchronous E-Learning

Synchronous e-learning facilitates "interconnectivity among people, sites, disciplines, institutions and nations, interactivity within the electronic machines, systems software and hardware, immediacy of feedback, integration of subject, curriculum and the products and process of technology [and] increasing accessibility to larger numbers of individuals" (Feyton & Nutta, 1999: 208). In practise this means that people of different cultures, time-zones and geographical areas can get together to meet, learn and interact using an increasingly diverse range of technologies including rich multimedia resources (Chen *et al.*, 2005: 183).

3.3.1.1 Instructional Advantages of Synchronous E-Learning

Synchronous e-learning offers a number of instructional advantages. Facilitators can solve problems as they arise and answer questions as participants ask them, providing necessary information or aid on a just-in-time basis (Horton, 2000: 55). This immediate interaction is commonly identified as important for a variety of reasons. Chen *et al.* (2005: 183) posit that it minimises the frustration that participants sometimes feel in asynchronous learning environments and allows them to use peer and facilitator corrective feedback timeously to strengthen what they have learned. They also suggest that it lends itself to team-teaching and interactive group learning

which can be pedagogically beneficial, as well as reducing the sense of isolation some learners have reported experiencing in asynchronous e-learning environments. Horton (2000: 55) highlights the ability of skilled facilitators to adapt to learners' needs as they work, tailoring learning materials and activities to the interests and requirements of the e-class, and also highlights their ability to give feedback on tasks and tests that are too complex for automated assessment. He goes on to suggest that the presence of a facilitator can provide the authority and structure that some learners require for motivation, creating a learning environment that they can relate to their face-to-face learning experiences. Chen *et al.* (2005: 183) concur, identifying the immediate feedback available from a live facilitator as integral to increasing motivation levels and creating a perceived obligation to be present and participate, thereby increasing students' involvement in learning activities.

Another benefit of the immediacy of interaction between participants and facilitators in a synchronous e-learning environment is the fostering of positive relationships due to the facilitators' ability to sympathise, empathise, encourage and inspire in real time (Horton, 2000: 55). Amongst participants, this same immediacy gives a sense of community and helps to create genuine relationships within the virtual learning environment (Balbar & Schwier, 2002: 58). The fact that participants are not physically present at the same venue still allows them a degree of anonymity in asking questions or speaking out, although less than in an asynchronous e-learning environment. This can be beneficial to shy learners or those lacking in confidence.

3.3.1.2 Logistical Advantages of Synchronous E-Learning

The synchronous e-learning environment is not merely an online version of a face-to-face environment. Hofmann (2004: 33) cautions that it requires most familiar classroom content to be delivered somewhat differently, in a manner tailored to heed the limitations and enjoy the benefits of the synchronous classroom. Nevertheless, synchronous e-learning facilitators can still utilise some of the tried and trusted instructor-led teaching methodologies that have proved successful for promoting interactivity in face-to-face teaching (Bean, 2005: 1), carrying these skills into the synchronous e-learning environment.

Online synchronous classes are more convenient than face-to-face classes for many participants due to the fact that they are location-independent which makes them accessible from anywhere with suitable technical facilities. Balbar & Schwier (2002: 58) even report some participants attending classes from Internet Cafés while travelling. Nantel (2004) describes synchronous e-learning as an ideal solution for teaching a geographically dispersed group of learners as physical location can never prevent a participant from attending as long as they have access to the Internet. Text-based synchronous classes can also be considered more convenient due to the ease of distribution and use of text chat software for synchronous e-learning (Chen *et al.*, 2005: 183).

The ability to record and archive live classes that have been conducted in an electronic environment makes these classes available to participants or other interested parties at a time that is convenient to them, an advantage usually associated with asynchronous e-learning.

3.3.1.3 Economic Advantages of Synchronous E-Learning

Synchronous e-learning has the advantage over traditional face-to-face courses of removing the need for participants to travel, saving time (Bean, 2005: 1) and lowering operating costs by reducing travel and lodging expenses (Nantel, 2004). Other costs related to time spent away from home or work are also reduced (Chen *et al*., 2005: 183). The increasing use of VoIP is contributing to this trend by facilitating voice communications over any distance thus reducing the need to make long-distance telephone calls (Nantel, 2004).

3.3.1.4 Overall Advantages

The American Society for Training and Development Survey (2006) identifies and rates six advantages of synchronous e-learning (see Figure 3.1), namely anonymity among peers when asking questions, reduction in time away from work, reduction in travel costs, recording and archiving of events, the facilitation of collaboration with peers and the value of interaction with live instructors and subject matter experts. Of these, the advantages rated most important by participants were the reduction in travel

costs and the value of interaction with live instructors and subject matter experts. Most of those who took part in the survey were working professionals.

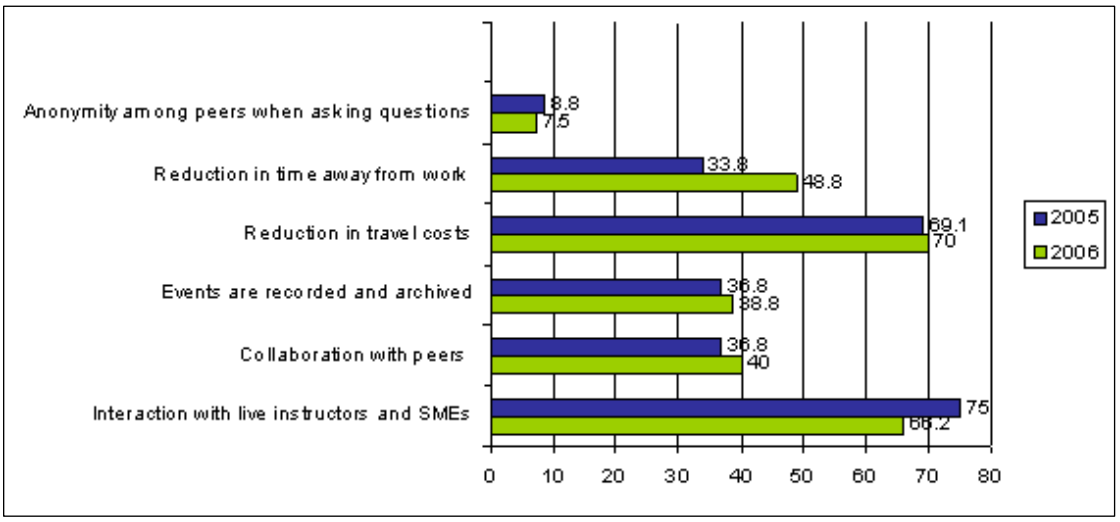

Figure 3.1- Benefits of Synchronous E-learning (American Society for Training and Development, 2006)

3.3.2 Disadvantages of Synchronous E-Learning

Synchronous e-learning technologies and environments are a relatively new development, and bring with them a new set of issues and problems.

3.3.2.1 Instructional Disadvantages of Synchronous E-Learning

As with asynchronous e-learning, synchronous e-learning necessitates a loss of face-to-face interaction and the associated loss of non-verbal cues. Where there is a voice component to synchronous e-learning, participants benefit from aural cues such as tone of voice. Video transmission is a possible solution to the lack of visual cues although it requires a certain minimum resolution below which accurate interpretation of visual cues becomes very difficult. Participant feedback tools such as mood indicators and emoticons also attempt to address this problem.

Synchronous e-learning is more structured than asynchronous e-learning meaning that students can not “skip around” in the manner possible with self study. Although this

greater structure suits some students, others find that it puts them under increased pressure in comparison with asynchronous courses (Bean, 2005: 2).

Although the job of the synchronous e-learning facilitator is in many ways similar to that of the traditional face-to-face educator, facilitators have to learn new skills including mastery of the new technology and new ways of working, teaching and interacting (Hofmann, 2004: 33). Participants also have to adjust to the synchronous e-learning environment, and their responses to technology can be challenging for the facilitator. Some find the necessary technology intimidating or confusing, while for others it can be extremely exciting; either of these extremes runs the risk of making the technology the focus of the learning event rather than the vehicle for its delivery. Other factors can also distract participants' focus from the learning event. Hofmann's (2004: 56) research indicates that it is not unusual for participants to be getting on with other work, interacting with colleagues in their immediate environment, playing games or even performing household tasks like defrosting chicken or folding laundry during a synchronous e-learning class. This sort of behaviour can be very difficult to identify or prevent; some learners revel in the fact that they can choose to "lurk" (Salmon, 2000: 19), appearing to be present but not contributing. Others whose personal learning styles are more passive or facilitative may be unfairly stigmatised as lurkers, contributing to a negative experience of synchronous e-learning (Czerniewicz, 2001: 18).

3.3.2.2 Logistical Disadvantages of Synchronous E-Learning

Technical problems are unavoidable and range from difficulties installing necessary software, low technical skill-levels of participants, and "technical glitches" encountered with software (Balbar & Schwier, 2002: 59), to technological disparities between countries and regions which beg the question of whether synchronous e-learning does in fact render geographical location irrelevant. How and from where content is served is important from the point of view of the quality of the audio and video experienced by participants. This is a significant consideration in Southern Africa where some areas are technologically at a first-world level and others, geographically close by, are technologically at a third-world level.

The fact that all participants must attend at the same time can also be a disadvantage (Henry, 2004), especially to participants from time-zones that differ significantly from that in which the course is scheduled.

3.3.2.3 Economic Disadvantages of Synchronous E-Learning

Compared to asynchronous e-learning, synchronous e-learning involves the extra expense of a live facilitator, and possibly a moderator. Where there is a voice component to a synchronous class, this requires either conference calling using a phone bridge, or the use of VoIP. The latter requires that sufficient low-latency and jitter-free bandwidth is available for the duration of the conference. A report prepared by Genesis Analytics (Pty) Ltd. (2005) for the South Africa Foundation indicates that the cost of both bandwidth and voice services in South Africa is significantly higher than costs for comparable services in comparable countries (those with similar geographical dispersion of population, market structure, telecommunications sectors and Gross Domestic Product *per capita*). A comparison of monthly fees charged to businesses in fifteen countries for ADSL broadband shows South African prices to be 148% higher than the average price (Figure 3.2).

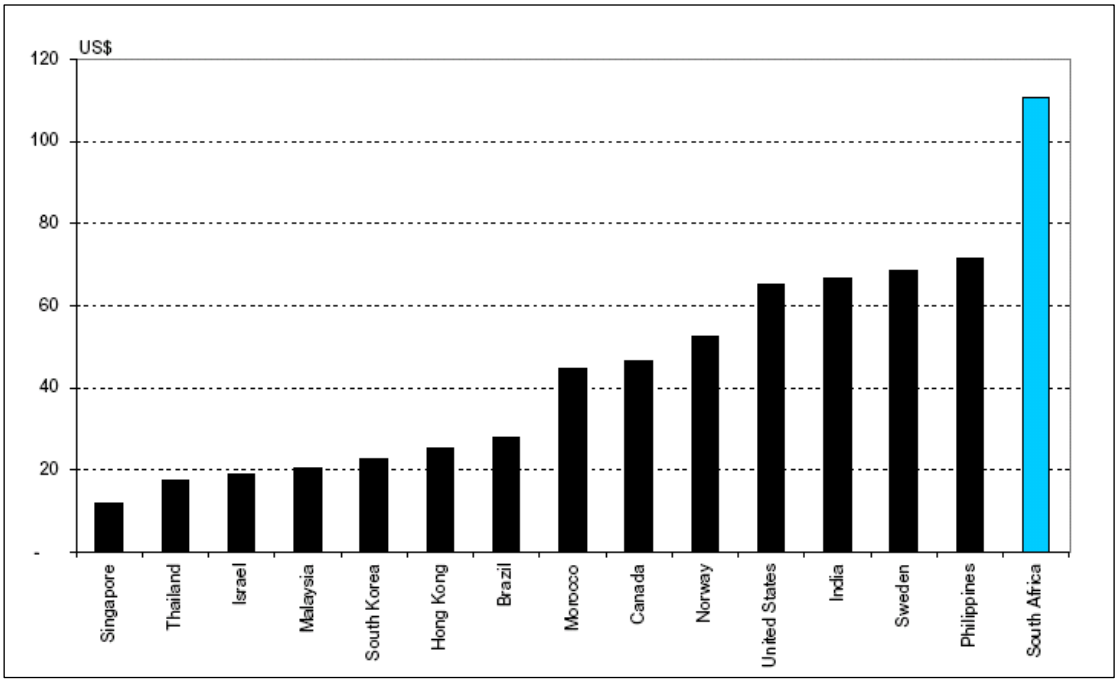

Figure 3.2 – Monthly ADSL Prices (Genesis Analytics (Pty) Ltd., 2005)

Similarly, for voice services, South African charges for fixed line local calls are 199% higher than the average price (Figure 3.3).

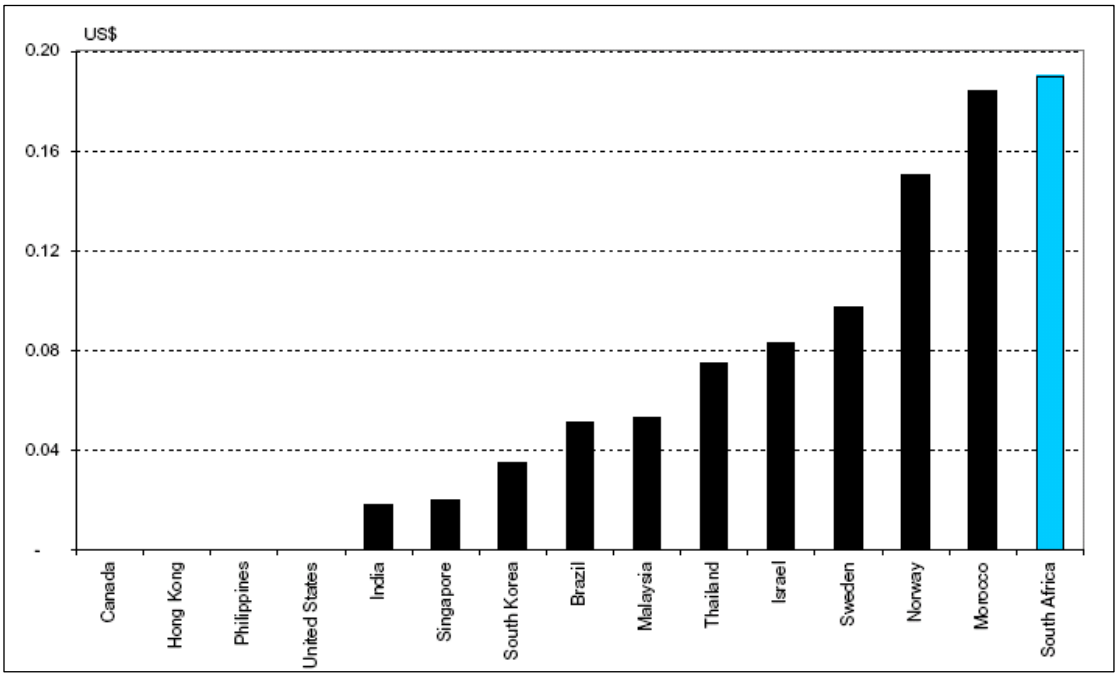

Figure 3.3 - Fixed Line Local Call Charges (Genesis Analytics (Pty) Ltd., 2005)

This being the case, the inclusion of live voice is a significant expense not necessitated by asynchronous e-learning.

3.4 Blended E-Learning

It is clear that there are distinct advantages and disadvantages to both asynchronous and synchronous e-learning. Early e-learning courses were often entirely asynchronous; however the efficacy of purely asynchronous e-learning is questionable. Chen *et al*. (2005: 182) identify a need for learning tools that support synchronous communications, based on research (including case studies, student/educator surveys, and behavioural analysis) into the effectiveness of asynchronous online learning. In practice, e-learning courses are increasingly moving away from purely asynchronous content, learning activities and events, with the trend being towards a more flexible blend of asynchronous and synchronous learning modes (Chen *et al*., 2005: 183).

Mantyla (2001: 3) defines blended e-learning as e-learning that involves two or more presentation/distribution methods which are combined to enhance both the experience of learning and the course content. This blended mode was initially commonly achieved by adding a synchronous component to an existing asynchronous e-learning course, using the different delivery mediums where appropriate to the needs of the course, to meet the desired learning objectives (Nantel, 2004). Horton (2000: 56) suggests that it is currently more accurate to categorise courses as existing on a scale of learning modes ranging from synchronous to asynchronous and indicating the amount of self-direction required of learners in completing activities.

Major (2001: 3) observes that many higher education institutions appear to be resisting blended technology delivery systems until their single-technology e-learning initiatives demonstrate cost-effectiveness. However, he predicts that the blended approach will eventually become ubiquitous; it allows learning modes to be put together in order to offer a multifaceted learning programme, like a complete virtual school. Such systems are more comprehensive than virtual classroom or virtual meeting packages, and are made up of a mixture of synchronous and asynchronous aspects, providing a complete package of features needed to assemble, administer and conduct an entire e-learning curriculum or course.

3.5 Selecting an E-learning Mode and Identifying a Potential E-learning Tool within This Mode

In investigating alternative e-learning solutions, synchronous and asynchronous options were considered and their instructional, logistical and economic advantages and disadvantages explored using Chen *et al.*'s (2005: 183) logical classification system. They are summarised in Table 3.1 (overleaf).

Synchronous e-learning combines many of the benefits of face-to-face learning (e.g. immediate feedback, the ability to adapt to learners' needs during the class and a degree of structure and authority to provide motivation) with some of the benefits of asynchronous e-learning (e.g. a degree of anonymity, and location-independence).

Table 3.1 - E-learning Modes Summary

	Asynchronous Learning	Synchronous Learning
Advantages		
Instructional	• Self-paced • Anonymity & privacy • Prevents undesirable classroom behaviours • Suits problem-based learning • Develops independence • Aids second language speakers	• Feedback can be provided on a just-in-time basis • Immediacy of responses reduces frustration and isolation • Suits team-teaching and interactive group learning • Content can be adapted to learner's needs during the class • Provides authority and structure some learners need for motivation • Fosters positive relationships • Retains a degree of protective anonymity for shy learners • Video and audio can provide visual and aural cues
Logistical	• Flexibility and resulting accessibility • Independent of location and time	• Some proven instructor-led teaching methodologies can be used • Independent of location • Recording and archiving
Economic	• Occasionally cheaper to implement when content is readily available in suitable format	• Reduced travel-associated expenses compared to face-to-face learning
Disadvantages		
Instructional	• No real-time interaction • No non-verbal cues (visual or aural) • Requires high motivation and discipline • Delayed feedback makes self-correction difficult • Lack of direct interaction causes isolation and frustration	• Fewer non-verbal cues than face-to-face learning • Greater structure does not suit all learners • Participants can just "lurk" or completely disengage
Logistical	• Large volumes of written correspondence for facilitators • More attention and feedback demanded of facilitators • More time-consuming for all • Prejudices those with weak written language and communication skills	• Technical problems (e.g. video and audio quality and latency) • Not independent of time • Requires higher bandwidth and more equipment (microphones, webcams, video-conferencing equipment *etc.*)
Economic	• Converting traditional content or creating new content is costly	• Facilitator (and possibly moderator) salaries • Bandwidth and/or teleconferencing expenses

The disadvantages associated with synchronous e-learning (e.g. lack of non-verbal cues, participant disengagement) are a result of participants not being in the same physical location, and were apparent with the use of the video-conferencing system, itself a synchronous technology. These disadvantages could be addressed by selecting a synchronous e-learning tool that maximises opportunities for the transmission of

non-verbal cues (by the use of audio and video feeds), and provides a more interactive and collaborative learning environment than that provided by video-conferencing. The Live Virtual Classroom (LVC) was identified as the web-based synchronous e-learning tool most likely to meet these criteria.

The use of LVCs as an alternative synchronous e-learning tool for the facilitation of distance learning is not novel, as a report by Reynolds *et al*. (2000: 935) indicates. Their study was motivated by the identification of a need for more flexibility in certain Continuing Professional Development Courses, held using the medium of video-conferencing, by the London Dental Schools. Reynolds *et al*. explored the viability of the LVC as an alternative tool over a period of a year, during which a number of LVC classes (on both LAN and Internet platforms) and standard video-conferencing classes were held. These classes all involved a single "teacher" and standardised course material, although the manner of the course presentation varied to cover a range of teaching scenarios. LVCs were found to necessitate much lower equipment costs than video-conferencing (2000: 936) and responses from users were described as "very positive" (2000: 935), with particularly enthusiastic feedback being received with respect to LVC's "chat box" functionality. Reynolds *et al*. (2000: 936) recognise that synchronous e-facilitation in the LVC is a skilled activity, cautioning that the use of LVCs for interactive web seminars may require potentially higher academic inputs from facilitators (a finding consistent with the literature (section 4.5 of Chapter 4)).

However, LVCs are found to offer pedagogical advantages over technologies like video-conferencing in that they can include pedagogical tools (e.g. collaborative whiteboards) that help to engage participants and scaffold the acquisition of meta-cognitive skills (McLoughlin & Hollingworth, in Dabbagh & Kitsantas, 2004: 42) while obviating the need for the more expensive and complex equipment required for video-conferencing (Reynolds *et al*., 2000: 935). They also offer an improvement on video-conferencing by virtue of features that, properly used, can improve the quality of teaching in general (Bower, 2006: 150). Reynolds *et al*. (2000: 936) conclude encouragingly that LVCs are more flexible than video-conferencing and essentially have "more potential as an educational tool" (2000: 936).

LVCs are a simpler and more easily extensible tool than video-conferencing, making them an attractive choice to provide an alternative to video-conferencing capable of successfully facilitating distance learning for the Universities. Synchronous e-learning was thus chosen as the e-learning mode for a proposed solution, and LVCs were investigated (Chapter 5) as the synchronous e-learning tool.

3.6 Conclusion

Whether or not synchronous e-learning is the appropriate solution for a particular e-learning event depends on a number of factors including the type of learning that is planned, the locations of the participants and the technology available to them, the duration of the course, and the budget for the course. At times, a blend of synchronous and asynchronous e-learning is necessary to meet the different needs of a class or course, as is the case in complete virtual schooling systems. However synchronous e-learning was found to offer a number of advantages over asynchronous e-learning in the context of the Universities' requirements, and was thus selected over asynchronous e-learning as the Universities' preferred e-learning mode. LVCs were selected as the synchronous e-learning tool to investigate as they are web-based, retain the benefits of video-conferencing (such as the transmission of non-verbal cues over both audio and video), and offer a number of features that are reported to be pedagogically beneficial in engaging learners. To further examine the value of these features, it was first necessary to understand the Universities' pedagogical context and approach towards teaching and learning, and this is investigated in the next chapter (Chapter 4). Thereafter an investigation was conducted into available LVC applications, in order to determine 1) what applications were available and 2) whether available applications met the Universities' pedagogical needs as determined in Chapter 4. The LVC investigation is detailed in Chapter 5.

Chapter 4 – Pedagogical Considerations

4.1 Introduction

LVCs are a new medium for learning that is rising in popularity in both the arena of business and that of formal education. As with all e-learning applications, LVCs are a tool for the facilitation of learning, a way of using technology to connect, energise, inform and stimulate people. They are a means to an end, not an ultimate goal, and are designed, created and used for the purpose of enabling learning. Feyton & Nutta (1999: 49) expound on the relevance of this truth to the introduction of a new e-learning technology:

> *A variety of theories of learning can be incorporated into virtual instruction, just as they can be incorporated into most other technology-based educational approaches. An often forgotten fact is that when any new medium or technology is brought into the educational picture, there is a responsibility on the part of those introducing it to understand its underlying educational theory, and ensure that that theory is not in contradiction with the overarching goals or vision of the educational experience that is intended.*

Thus in determining whether the LVC is a suitable synchronous e-learning tool for use by the Universities, it is necessary first to identify the pedagogical framework in which the tool will be used in order to ensure that the tool offers the functionality to support that pedagogical framework. The paucity of available literature addressing the pedagogical issues surrounding synchronous instruction (Chen, Ko, Kinshuk & Lin, 2004: 1) only makes this all the more vital.

4.2 Overview of Approaches in Current Pedagogical Theory

Theories as to how human beings learn are plentiful, and the body of knowledge is constantly being updated and amended. However, over the past century two main approaches to education have dominated: the instructor-centred approach and the learner-centred approach. Today these approaches incorporate a number of distinct

theories which nevertheless have common elements. Each approach can be exemplified by a particular theory that establishes a philosophical paradigm for the understanding of learning.

4.2.1 The Instructor-Centred Approach and Behaviourism

The instructor-centred approach is one in which the focus in the process of teaching and learning is on the instructor. The approach is exemplified by the behaviourist theory of B.F. Skinner in which learning is understood as a process of behaviour modification, based on operant conditioning (Schunk, 2004: 48). In behaviourist teaching, learners are presented with a stimulus in the form of a question or problem (e.g. "What is 7 × 5?") and they attempt a response. Correct responses are positively reinforced in some way (e.g. by praise or a good grade) while incorrect answers are both corrected and negatively reinforced (e.g. by criticism, punishment or a bad grade). The process of reinforcement enables the learner to come to associate the correct answer for a particular question with that question every time the stimulus is presented (Schunk, 2004: 53).

Content is viewed as a collection of stable, indisputable facts about an 'objective' external world. As such single perspectives are offered and facts can be learned and represented in anyone's understanding in the same manner. Subject matter to be learned is broken down into discrete subjects which are further compartmentalised into facts for transmission to learners. Jonassen (1991: 8-10) warns that facts become decontextualised in the process of simplification.

The behaviourist theory is sometimes referred to as a 'jug and mug' theory because it assumes that learners are empty 'mugs' waiting to be filled up from the plentiful 'jug' represented by the instructor. The instructor's role is that of knowledge expert, and the instructor is believed to have a complete and 'correct' understanding of the world in their area of expertise. The process of teaching, then, is one of actively breaking down the vast body of knowledge this expertise represents into discrete, easily conveyable units which can be taught to the learner. The role of the learner is to understand and assimilate these units, allowing the instructor's exact knowledge structures to be mapped onto their own minds. It is common misconception that learning occurs

passively according to the behaviourist theory; Skinner believed that learners *do* need to play an active role in the learning process. They do not however drive the process, nor do they have any control over it in a traditional instructor-centred class (Burton, Moore & Magliaro, 1996: 46).

The purely instructor-centred approach as exemplified by behaviourist teaching has been criticised for excluding the role of the mind, discouraging critical thinking, providing no theoretical foundation for higher order thinking skills, de-contextualising learning, discounting the value of personal experience and fostering a reliance on extrinsic rather than intrinsic motivation (Macrae, 2001: 72). Its use as a basis for teaching and learning in developed countries worldwide is declining as it conflicts with current understanding of how meaningful learning occurs.

4.2.2 The Learner-Centred Approach and Constructivism

The learner-centred approach is one in which the focus in the process of teaching and learning is on the learner, and is exemplified by the constructivist theory. Current constructivist teaching practice incorporates ideas from a range of learning theories and grew out of the work of Lev Vygotsky (social development theory and the zone of proximal development), Jean Piaget (cognitive structures for child development), and Jerome Bruner (constructivism itself) in the latter half of the 20th century (Kearsley, 2006).

Constructivism views the learner as an active agent seeking to make sense of the world (Jolliffe *et al.*, 2001: 21). Learners are not 'blank slates' awaiting the inscription of knowledge by a knowledge expert, but individuals with existent life experiences and ways of viewing the world. Constructivism is typical of learner-centred instruction in that it allows learners to take a much more active and directing role in what they are learning than instructor-centred instruction. Learning takes place by interaction, both with others (such as peers and teachers) and with the environment, through personal experience and activities (Jolliffe *et al.*, 2001: 21). It is anchored in the context in which it occurs, and must occur in a meaningful context in order to be meaningful to the learner. Learners construct or build knowledge and meaning (rather than having it transmitted to them) by selecting and transforming

information, constructing hypotheses, and making decisions, relying on their personal cognitive structure to do so (Kearsley, 2006). New information taken in by learners is thus accommodated or assimilated based on their existing cognitive structures. Jonassen, Peck & Wilson (1999: 4) explain that the process of meaning-making creates perceptions of the external, physical world that are unique to the person involved in the process, due to the unique nature of each individual's set of experiences and combinations of beliefs about the world.

For knowledge to be constructed, learners need to articulate or reflect on what is learned in some manner, be this alone (e.g. in the form of a journal entry or a reflective essay) or with others (e.g. in discussion or collaborative written reflection). Interaction with others is particularly valuable as learners are exposed to multiple perspectives and ways of viewing the world, and must socially negotiate meaning by collaboration and cooperation (Jonassen *et al.*, 1999: 5 - 10). Vygotsky's social development theory extrapolates on this premise to suggest that collaboration with others, be they peers or teachers, extends learners' abilities beyond what they could accomplish alone (Kearsley, 2006).

Constructivism's removal of the teacher as the central authority in the learning environment requires a drastic shift in the role of the teacher, constituting a move away from traditional behaviourist principles (Feyton & Nutta, 1999: 52). The role of the teacher changes from that of 'sage on the stage' transferring knowledge to learners, to that of 'guide on the side', aiding and facilitating the learning process in which each learner is naturally engaged. Teachers provide stimulation for inquiry, and actively engage with learners to support them in discovering principles, thinking critically and drawing conclusions on their own.

The learner-centred approach as exemplified by constructivism is criticised as being more time-consuming for learners (Maddux, Johnson & Willis, 2001: 172), more complicated to implement than traditional instructor-centred teaching, and requiring richer resources (Jonassen, 1994: 34 - 37). It is, however, widely believed to foster the development of deeper, more authentic and lasting learning, and to promote independence and critical thinking (Jonassen *et al.*, 1999: 9 - 10), for which reasons it is steadily becoming the dominant educational paradigm in Western education.

Collaborative constructivism is the most commonly adopted teaching strategy in online education (Trentin, 2002: 57).

4.3 The South African Context

The Apartheid era in South Africa gave rise to a number of problems in the education system (Wilmot, 2005). Primary and secondary education was fragmented into different programmes for different racial groups. The quality of education ranged widely between these programmes. Many people were denied access to education, and many of the youth who were politically active missed out on large portions of their schooling. Access to tertiary education was dependent on performance in secondary education and was inaccessible to those who had not completed secondary schooling. Thus, in order for people to become educated, they needed to return to school. Alternatively, education structures paralleling primary and secondary education, but more appropriate to adult learners, needed to be put in place. Whatever was to happen it was clear that the traditional idea of people completing their education by the time they reached their early twenties no longer applied. For this reason the South African Qualifications Authority Act of 1995 established the South African Qualifications Authority (SAQA), with a mandate to develop and implement an integrated national framework of learning that would assure the quality of achievement in accordance with prescribed national standards (Departments of Labour and Communication, 2003). This framework is the National Qualifications Framework (NQF).

The objectives of the NQF as specified in the SAQA Act (Government Gazette, 1995) are to:

- create an integrated national framework for learning achievements;
- facilitate access to, and mobility and progression within, education, training and career paths;
- enhance the quality of education and training;
- accelerate the redress of past unfair discrimination in education, training and employment opportunities; and thereby

- contribute to the full personal development of each learner and the social and economic development of the nation at large.

In order to accomplish these objectives the NQF groups education into eight levels making up three education and training bands: 1) General Education and Training (including primary education and secondary education up until grade 9; 2) Further Education and Training (including secondary education from grade ten to grade twelve, college and trade certificates); and 3) Higher Education and Training (including diplomas, occupational certificates, higher diplomas, degrees and higher degrees). Provision is made for Adult Basic Education and Training (ABET) to take place outside of traditional primary education structures, and every educational qualification is situated somewhere within the framework, making it possible to easily determine paths for progression. The learning outcome was chosen as the principle by which to organise and standardise qualifications on the framework (Boughey, 1999: 4), making Outcomes Based Education (OBE) one of the major underlying pedagogical principles of education in post-Apartheid South Africa.

4.3.1 Changes to South African National Educational Policy Post Apartheid

Post-Apartheid South African education policy prioritised the need to replace the instructor-centred, strongly behaviourist pre-1994 primary and secondary education system with a unified and modernised system. The instructor-centred approach is predicated on a positivist epistemology, a way of understanding the world in which there are factual absolutes that simply need to be transmitted and understood. Under Apartheid this pedagogical approach helped to discourage learners from challenging or criticising what they were being taught, particularly in arenas such as history, which in turn helped to support the existent political hegemony. This formed part of the motivation for the national Department of Education's move away from an instructor-centred approach to teaching and learning: the new system would need to help to mould critical thinkers with skills relevant to the demands of today's job market as well as redress existing imbalances in an equitable manner. It was important to break from the Apartheid mentality of educating for two distinct "streams" of academic and vocational learning, and this required a shift in pedagogical theory.

In Curriculum 2005 (C2005) the Department of Education chose to switch from a system grounded in the principles of positivist epistemology and behaviourist learning theory to a learner-centred, outcomes based system with a strong focus on constructivism and collaborative learning (Wilmot, 2005: 35).

Some of the key features of the new curriculum framework that Wilmot (2005: 35 - 36) identifies include an emphasis on participation and interaction in learning, characterised by a significant increase in activity-based learning, a shift from a teacher-centred didactic approach to a learner-centred didactic approach (changing the role of the teacher to that of a facilitator of learning), and an associated encouragement of a climate of non-authoritarianism.

C2005 was implemented in South African primary and secondary schools nationwide, although to different extents and in different and uneven ways. Most schools have essentially adopted a blend of constructivist principles and traditional instruction, guided by a focus on goals and learning outcomes (Harley and Wedekind, 2004: 195 - 213). Factual knowledge retains a vital place in education at all levels, and the transmission of such factual knowledge needs to take place, at times, in a traditional teaching or lecturing manner, even if simply due to time constraints. The implementation of C2005 at the primary and secondary educational levels is relevant to tertiary education because it impacted the national educational climate at all levels. It has carried over into tertiary education both in terms of influencing policy at tertiary educational institutions, and in terms of the manner in which it has shaped the learning character of people entering tertiary educational institutions from C2005 schools.

4.3.2 Tertiary Education

Courses at the tertiary education level are situated within the NQF. In order to avoid compartmentalising and thus decontextualising tertiary education (which would be contrary to its very ethos) the NQF requirement that learning outcomes should be written for all courses and modules leading to qualifications was waived at tertiary level. It was agreed that universities would be allowed to register whole qualifications

on the framework meaning that, for example, outcomes are written for degrees in their the entirety rather than for individual components, and that the whole degree is then registered on the NQF (Boughey, 1999: 8).

The requirement that outcomes be specified for degrees has entrenched OBE principles as a part of the tertiary education landscape. These principles emphasise the importance of the development of an ability to work independently and to apply what has been learned to solve relevant problems in a particular discipline. Boughey (1999: 5) explains that in order to achieve this effectively it is necessary to move away from simply using teaching to explain disciplinary content, to teaching more facilitatively in order to create a space for students to interact with their peers and their lecturers in the process of solving problems. Interactivity in learning is thus a vital component of South African tertiary education as well as secondary and primary education. The shift from an instructor-centred approach to a learner-centred approach is apparent at all levels, and is evident at Rhodes University in the Policy on Curriculum Development and Review which states that curricula should be learner-centred and should describe content, skills to be developed and fundamental viewpoints as well as specifying outcomes (Rhodes University Academic Planning and Quality Assurance Office, 1998: 2).

Next-generation live e-learning tools like LVCs, envisioned to facilitate engaging, participatory classes (Dalal, 2003), support the sort of interactive and facilitative teaching and learning identified as appropriate in South African tertiary educational institutions. LVCs allow for the transmission of voice and video over the Internet (Van Dam, 2004: 58), and would provide a means for interaction and collaboration, both between participants and facilitators and within groups of participants. They are thus ideally suited to the South African secondary and tertiary education arenas.

4.4 The Importance of Interactivity and Collaboration to E-Learning

The rise of the learner-centred approach to teaching and learning, and the increased focus on learning outcomes worldwide, has led in turn to an increased focus on

interactivity in learning, both in the face-to-face classroom and online. In e-learning in particular, promoting and sustaining interactivity is considered vitally important: literature indicates that distance-learning practitioners view interactivity as the defining attribute of the quality of the experience of learning at a distance using technology (Hamza, Perez & Checker, 2001; Trentin, 2002: 61; Howard: 2006: 15-18).

Trentin (2002: 57 - 61) posits that online learning is essentially collaborative, and relies for its success on educational activity being structured in such a way that interaction amongst the participants results in the collective growth of the group. Small learning groups are best to encourage the interactivity he cites as integral to achieving high quality online education. In a case study on the adoption of LVC training by Hitachi Data Systems, Howard (2006: 18) reports that the company received positive feedback from nearly 100% of participants in their pilot LVC synchronous training program (operating on the aforementioned interactivity principle). The only exception was, significantly, a participant who had viewed a recording of the class and had thus not been able to interact in any way with the facilitator or other participants.

Howard's (2006) findings are underscored by studies that reveal that working collaboratively in groups is experienced as a more effective and satisfying learning experience by learners, and stress that communication and conversation are key to achieving learning goals (Van Dam, 2004: 57). The American Society for Training and Development's 2006 Synchronous E-Learning Survey, which rates features of synchronous e-learning systems, also supports these findings; the three most highly rated features viewed over the two year period of the survey (2005 and 2006) are application sharing, interactive quizzes and surveys, and Two-way VoIP, highlighting the importance of interactivity to participants (Figure 4.1).

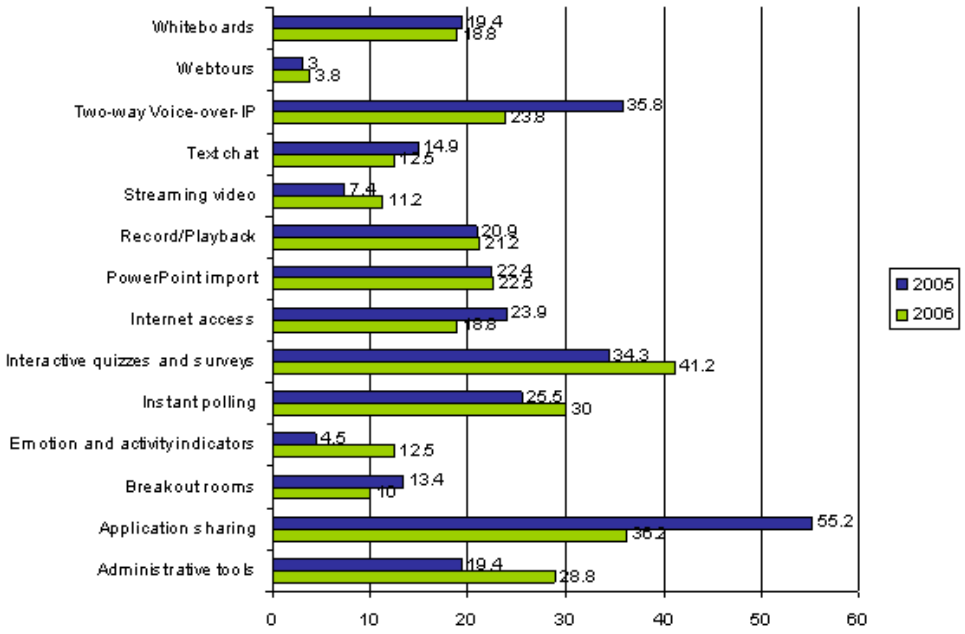

Figure 4.1 - Common Features of Synchronous E-learning Systems (American Society for Training and Development, 2006)

4.5 E-Facilitating

Resistance is often experienced from educators changing to the use of a new instructional medium, due to a variety of factors including fear of the new medium and worry about achieving successful classes (Howard, 2006: 18). In the case of the LVC, commercial 'webinars' (web seminars) that are little more than recorded lectures have frequently misrepresented the scope and flexibility of the LVC, making the medium appear unattractive to facilitators. This impression can by overcome by specific synchronous facilitation training (Howard, 2006: 18) that educates facilitators about the benefits provided by the technology, teaches them to use the medium effectively and allows them to gain confidence in its use.

The need for facilitator training is supported by the literature. Major (2001: 4) sees high quality training for distance education facilitators as a necessity, explaining that a lack thereof results in distance education programs falling into a state of crisis and being discredited. Kunz (2000: 1646) explains that facilitators' teaching styles need to be adapted to be appropriate to new mediums and modes. In a synchronous e-learning environment he believes that this requires extra effort on the part of the facilitator, in order to succeed in the creation of an atmosphere conducive to the encouragement of

interaction and collaboration amongst participants. Howard (2006: 10) concurs, and stresses the importance of live synchronous instruction being of high quality, maintaining that students learn even less from a bad LVC course than they do from an ineffective teacher in face-to-face classroom.

The selection and practice of pedagogical strategies appropriate to a given educational environment correlates highly with academic achievement (Dabbagh & Kitsantas, 2004: 41). Although synchronous e-learning facilitators can still utilise some of the tried and trusted instructor-led teaching methodologies that have proved successful for promoting interactivity in face-to-face teaching (Bean, 2005: 1), as mentioned earlier, most content will need to be delivered differently in a synchronous environment (Hoffman, 2004: 33). Simply reproducing a traditional-classroom, instructor-centred lecture in the LVC environment results in subjecting participants to the disadvantages of the medium discussed earlier (section 3.3.2 of Chapter 3), and prevents them from benefiting from its advantages. The transmission of learning content must be learner-centred and relevant to the medium of the LVC – meaningful, contextualised learning can not occur without contextualised, interactive, flexible, dynamic facilitation. Trentin (2002: 57) posits that synchronous e-learning is a pedagogically unique environment and as such requires the fusion of relevant aspects of existing pedagogical theory with new research into the topic, to create a collaborative "network pedagogy"[2]. This being the case, it would be misguided to compare face-to-face teaching to synchronous e-learning as distinct pedagogical paradigms apply to each of these learning modes.

Dabbagh & Kitsantas (2004: 45) list competencies critical to the role of the "web-based instructor". These include the promotion of interpersonal communication and feedback, interaction, collaboration, and teamwork, as well as the understanding of any pedagogical tools used in the online environment and their impact on learners. Trentin (2002: 61) highlights the importance to successful online education of those in a teaching role acting as facilitators of learning rather than direct instructors, in which capacity they would take part in and reflect on the learning process along with

[2] New pedagogical theories applicable to different learning paradigms in the digital age are currently under development in e-learning communities of practice. An example is Connectivism (Siemens, 2005).

participants (Dabbagh and Kitsantas, 2004: 45). Hoffman (2004: 31) concurs, explaining that completely instructor-centred lectures fail in the LVC as they do in video-conferencing (Kunz, 2000: 1645); participants disengage, their attention wanders and they turn to other tasks. Collaborative classes that keep participants actively involved are dependent on successful synchronous facilitation (Hoffman, 2004: 56); a facilitator who is not interacting with participants frequently will not notice if they have lost interest, or even worse, left their computers to do something else entirely.

Howard (2006: 15) suggests best practice guidelines for synchronous e-facilitation, recommending short class sessions of no more than three hours that are highly interactive (with interaction taking place every three to five minutes) and that employ as wide a range of the available tools as possible. If slides are used, the inclusion of exercises for participants every ten to fifteen slides is recommended.

4.6 E-Moderating

The word “moderation” in an e-learning context is most frequently used to refer to the activities of asynchronous e-learning moderators who preside over areas such as forums and discussion groups. Their role involves, amongst other things, accepting and rejecting posts, ensuring compliance with rules, changing technical settings and encouraging discussion (Salmon, 2000: 3 - 19). Synchronous e-learning moderators, also called producers/instructors/assistant trainers, play a significantly different role to asynchronous moderators, but one that is vital to the maintenance of a high level of interaction with participants in a LVC (Hofmann, 2004: 38). Some LVC applications, such as Interwise ECP Connect (Figure 5.1), use the term “moderator” to refer to the facilitator role, which can be a source of confusion.

There are a variety of tasks that can benefit from the presence of a moderator, whose contribution can help to avoid the problems of role-overload for facilitators in LVCs identified by Johansson *et al*. (2005). These include welcoming participants into the classroom and talking them through the technicalities of getting everything (such as the classroom application itself, and the audio and video) working properly. The moderator role can be filled by other facilitators, which can come in very useful as the

moderator can then back up the facilitator wherever necessary, facilitating the class for brief periods, or working together with the facilitator to do so in case of emergency (e.g. if the facilitator loses their Internet connection but retains their phone bridge connection, the moderator can carry out the classroom tasks such as moving from slide to slide, loading/opening files, annotating slides and writing on whiteboards) in such a way that technical hitches are barely apparent to participants. Hofmann (2004: 38 - 47) suggests that where facilitators encounter very mixed ability or experience levels in a virtual class, a moderator with facilitation experience of the content can take on the role of teaching aide and manage an exercise (e.g. via the text chat area) with the more experienced or more able participants, while the facilitator concentrates on the less experienced or less able participants for a while to attempt to bring them up to speed. This sort of approach helps to prevent participants logging off early or wandering away from their computers due to boredom or frustration.

Working behind the scenes, moderators can provide technical help to the participants or answer any other questions they may have (chatting to them using text chat, or in an audio breakout room if available, to avoid disturbing the class). They can keep an eye on the live text chat area where crucial interaction can occur (Hofmann, 2004: 40) and analyse participants' comments in order to provide feedback to the facilitator on topics such as how well the class is being engaged and possible problem areas, both in terms of the content of the class and in terms of potential technical problems. They can gather and analyse data from the classes, such as participants' feedback on whiteboards and in polls, which can be used to improve the content and quality of classes. They can create just-in-time polls and content, or launch polls, websites, shared applications, and breakout rooms, leaving the facilitator free to concentrate on interaction with participants. In short, the moderator's primary function is to work behind the scenes to ensure a seamless learning experience unless circumstances make it necessary for them to take on a more central role.

4.7 Conclusion

Both secondary and tertiary education institutions in South Africa operate on an underlying basis of learner-centred, OBE principles. At both educational levels the issue of interactivity to promote deep and genuine learning is of importance. LVCs

are identified as synchronous e-learning tools that support the pedagogical principles important to the Universities and to the broader context of South African tertiary education, indicating that they are likely to be a good choice as an alternative to video-conferencing. Teaching in a synchronous e-learning environment is significantly different from teaching in a traditional face-to-face classroom and involves different roles such as those of the e-facilitator and e-moderator. Using LVCs requires educators to familiarise themselves with these roles, aspects of pedagogical theory relevant to holding successful collaborative, constructive classes online, and the LVC medium itself. It would thus be wise to seek an LVC solution that is appropriate for the facilitation of small, highly interactive academic groups, is powerful, and is relatively simple. This would allow lecturers to take advantage of the LVCs' features, concentrating on e-facilitation without being burdened with an over-abundance of complexity.

Chapter 5 – Live Virtual Classrooms (LVCs)

5.1 Introduction

LVCs are made up of a number of synchronous applications (usually including a minimum of one voice and one visual component) integrated to facilitate teaching and learning. Most commonly accessible over the Internet, they combine the benefits of traditional face-to-face classroom learning with the sophistication of Internet technologies such as video transmission and VoIP (Van Dam, 2004: 58). LVCs were identified as the most promising synchronous e-learning alternative to video-conferencing within both Universities' technologically rich environments.

At present a wide range of LVC applications exist, and these offer a broad spectrum of functionality, designed to meet the requirements of their target markets. Nantel (2004: 2) loosely classifies LVCs into three categories: 1) "live e-learning systems" containing features aimed specifically toward training, 2) "Web conferencing products", designed for meetings, brainstorming and teamwork, and 3) "virtual classroom systems" which attempt to recreate the classroom in an online, live format by including features like hand-raising. In reality there is no hard and fast categorisation system and the terms Nantel identifies are sometimes used interchangeably.

This chapter examines and evaluates a number of LVC applications in order to determine the value of individual features to the pedagogical environment envisaged for the Universities, and the suitability of each of the distinct applications as a replacement for video-conferencing in the context of the Universities' needs.

5.2 Common Features of LVC Applications

A large number of LVC applications are available commercially. Eleven of these were identified, based on their popularity as determined by assessing the most commonly mentioned solutions in the literature, and by recommendation of those involved in the industry (from telephone conversations with marketing representatives to conversations, by text chat or email, held with participants and faciltators in public

webcasts). Another solution, Webhuddle, was added to this list by virtue of the fact that it is both free and open-source, as this would mean it was both customisable and cost effective. Twelve commercial LVC solutions (Netbriefings eConference Pro, Horizon Wimba's Live Classroom, iLinc LearnLinc, HP Virtual Rooms, Elluminate Live!, Interwise ECP Connect, WebEx Training Center, Adobe Breeze, Avacast Avacaster, Microsoft Livemeeting, Genesys Meeting Centre and Webhuddle) were thus surveyed.

Trial logins, allowing the LVCs to be used for free for up to a week, were obtained for all the applications except Webhuddle, and demonstrations were given by marketing representatives of the companies concerned, who also helpfully answered questions by email and telephone. Webhuddle allowed prospective users to create trial accounts for themselves, and provided documentation as part of the project. Each of the twelve chosen solutions was evaluated (sections 5.2.1 to 5.2.13 of this chapter) in terms of its feature set and potential suitability for the Universities' needs, and a comprehensive matrix of the capabilities of each was drawn up, and is available in Appendix D. From this evaluation process, thirteen standard features present in the majority of the applications, and considered important by their developers, were identified, and are discussed in detail in this chapter. These features are summarised along with their prevalence in each application (Table 5.1 overleaf).

These features were identified with reference to the Hoffman's (2004: 14 - 28) list of features common to synchronous training packages, but differed in some respects: 1) learner-testing functionality or external testing software was not considered as the focus was on the suitability of LVC applications as an alternative teaching and learning (as opposed to assessment) solution to replace video-conferencing, and 2) associated asynchronous discussion boards were not considered as it had already been established that a synchronous solution was required.

Table 5.1 – Summary of Standard LVC Features

Feature	Description	Prevalence
Attendee Lists	Display participant name and role in list.	12/12 (100%)
Audio	In the form of VoIP/audio-conferencing using traditional telephony/a combination of the two.	12/12 (100%)
Text Chat	Messaging/feedback to all, facilitator, or moderator.	10/12 (83%)
Slide Shows	Enable presentation of factual material in a manner familiar from face-to-face classes.	12/12 (100%)
Whiteboards	Enable annotation of text, diagrams and drawings.	11/12 (92%)
Surveys/Polls	Enable automated Q&A and feedback.	12/12 (100%)
Participant Feedback Tools	Hand-raising, emoticons, technical feedback.	6/12 (50%)
Breakout Rooms	Entry to virtual rooms for breakaway groups.	7/12 (58%)
Live Video Streaming/ Conferencing	Facilitator broadcast or multi-person conferencing.	8/12 (67%)
Application Sharing	Facilitator's software applications display to participants, and sometimes allow interactivity.	12/12 (100%)
Privilege Separation	Facilitators have greater access to functionality, shielding participants from unnecessary complexity.	12/12 (100%)
Synchronised Web Browsing	Allows the facilitator to open a webpage on every participant's computer at the same time.	8/12 (67%)
Recording/ Archiving	Recordings can be played back asynchronously and edited into formal archived video lessons.	12/12 (100%)

The relative importance of LVC features could not simply be determined by their prevalence in the LVC applications. Features have different pedagogical values dependent on the context in which they will be used and the functionality they can offer a class and a facilitator; a closer examination of the standard LVC features that had been identified was thus undertaken to clarify their purpose and importance in a LVC. Each feature was further considered in terms of the Universities' teaching and learning requirements.

5.2.1 Attendee Lists

Attendee lists show which participants are logged into a LVC at a given time. They can indicate the role of each attendee (e.g., whether they are a facilitator, a moderator

or a participant) by using text or icons as in Figure 5.1 [A] where moderator icons include mortarboard hats and are textually labelled, or Figure 5.1 [C] where the facilitator icon includes a microphone to show that the attendee in question is giving the lecture. Attendee's status (e.g. whether they are physically present or whether they have had to step away from their computer for a brief period of time) can be indicated by text labels. Attendee lists can also indicate the quality of attendees' connections, as in Figure 5.1 [B] where this is represented by a number of coloured bars, or Figure 5.1 [C] where the light next to each attendee's name can range from green (for a good connection) to red (when an attendee has just been disconnected). When attendee lists incorporate a status indicator, both facilitators and participants can interpret the events taking place in the LVC and respond accordingly (e.g. not expecting replies from participants who are away or have been disconnected, or coming to the aid of those with their hands up). By allowing participants to see who is in the virtual room, attendee lists help to create a real-time sense of presence in the virtual class, reducing the loneliness identified as a disadvantage of asynchronous e-learning by Porto (2005) and Barclay (2001). Attendee lists are thus considered a necessary feature of any LVC to be selected for the Universities' use. All LVCs evaluated included an attendee list.

Figure 5.1 - Attendee Lists as Implemented by [A] Interwise, [B] Adobe Breeze, and [C] HP.

5.2.2 Audio

Audio provides immediacy of communication and interaction with the resultant benefits discussed in section 3.3.1 of Chapter 3. Audio communication was a feature

of every LVC evaluated, present in the form of VoIP, audio-conferencing using traditional telephony (e.g. phone bridges), or a combination of the two. Whether traditional telephony is a better choice than VoIP or not depends on the situation; for example, for participants with limited bandwidth or an unreliable network connection, traditional telephony could be a better option than VoIP, while in reliable high bandwidth environments VoIP is a simple and inexpensive option. VoIP can be implemented as half-duplex audio as in the Elluminate Live! classroom (only one person can speak at a time as audio can only be transmitted in one direction at a time) or full-duplex audio as in the Horizon Wimba Live classroom and HP's Virtual Room (allowing people to speak simultaneously without having to formally pass control of the audio, as audio can be transmitted in two directions simultaneously). Some LVC applications, such as iLinc's LearnLinc and WebEx's Training Centre, allow audio to be configured as either half- or full-duplex.

The ability to cut out background noise from participants' environments when they are not speaking was found to be a very valuable feature during the LVC assessments. Some LVC applications achieve this by providing a feature for audio muting (Figure 5.2), either as an option that can be set by the facilitator/moderator for the duration of the class, or via a clickable button in the classroom. Most phone bridges over traditional telephony also offer this option, simulating an on/off switch for muting by using a combination of buttons on the phone.

Figure 5.2 - iLinc LearnLinc's Audio Control Panel Showing Mute Button (←)

Other LVCs like Elluminate Live (Figure 5.3) default to audio silence and implement a talk button that needs to be clicked to transmit audio.

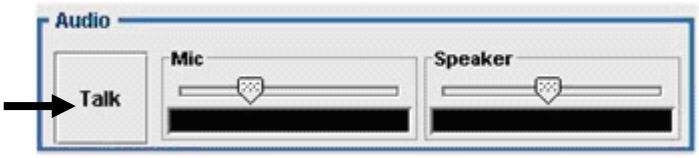

Figure 5.3 - Elluminate Live!'s Audio Control Panel Showing Talk Button (→)

Traditional telephony is too expensive to be a viable option in the Universities' context (as discussed under economic disadvantages of synchronous e-learning, section 3.3.2 of Chapter 3). Audio communication in any LVC selected for the Universities' use should thus ideally be implemented using VoIP. VoIP transmitted to and from internationally hosted applications requires heavy use of expensive international bandwidth (section 3.3.2 of Chapter 3) however, and the quality of audio is often low. Five of the twelve LVCs evaluated (iLinc LearnLinc, Adobe Breeze, Avacast Avacaster, Webhuddle and Genesys Meeting Centre) obviated this problem by offering the option of either having the application served from within South Africa, or purchasing a server edition of the application in order to run a local server.

Clear and reliable audio communication is a vital feature that must be included in any LVC for the Universities' use.

5.2.3 Text chat

Text chat gives participants in a LVC the ability to send messages to the facilitator, the moderator, other participants, or sometimes a combination of these people such as the entire group or all the participants/facilitators. Its use can be viewed as 'note-passing' in the traditional sense and is discouraged by some facilitators (Hoffman, 2004: 38-40). Some LVCs, like Avacast's Avacaster, are not designed to allow participants to communicate with one another by text chat at all. Text chat can, however, allow participants to ask private questions, ask for technical help or discuss a point with their peers without interrupting whoever is speaking over the audio. It also contributes to the development of a sense of community in a virtual class and lessens the potential for feelings of isolation sometimes experienced by learners physically distanced from their peers (Balbar & Schwier, 2002: 62). Text chat is pedagogically beneficial too; having the chat window available helps to prevent

boredom setting in and causing attention to wander away from the lesson. If this does happen, monitoring the chat can give a good indication of the extent to which participants are disengaging, giving the facilitator or moderator a clue that they need to introduce an activity or a relevant example (Hoffman, 2004: 40). Text chat can be used to elicit simultaneous responses to a question from all participants, making collaboration faster and easier, and enables a facilitator to use 'dual coding' (emphasising a point by typing it into the chat window as well as speaking about it over the audio), thus engaging participants with diverse learning styles (Bower, 2006: 150).

LVC applications such as Interwise ECP Connect and Elluminate Live! offer the facility to save text chats as a document, while others like Horizon Wimba's classroom will record them along with the rest of the class if it is being recorded (usually from the point of view of the person doing the recording, thus not including all the private messages if there are any). When 'dual coding' is used during a class, points entered into the chat window mark the places in the chat archive that particular topics or concepts were introduced (Bower, 2006: 150).

All LVCs evaluated included some text chat or private messaging functionality. The Universities' require a simple LVC solution (section 4.7 of Chapter 4) and so, although text chat is a necessary feature, their text chat needs are simpler than the facilities these offer. Text chat should ideally 1) allow both participants and facilitators to send and receive messages, 2) provide a way to identify the sender of a message, 3) store a chat history so that those joining the class late can catch up on the chat and anyone who is disconnected can, upon reconnecting, see what has occurred in the chat while they were offline, and 4) provide a mechanism to clear messages for privacy and in order to start afresh for a new class. Private messaging is considered unnecessary and could impact negatively on the open, communicative and collaborative atmosphere envisioned for the synchronous e-learning class.

5.2.4 Slide Shows

Slide shows allow material to be presented in a manner with which both facilitators and participants are likely to be familiar from their experiences with face-to-face

presentations. They are important to include in a LVC for the times when factual content needs to be transmitted, and are a feature common to all the LVCs evaluated. MicroSoft PowerPoint slides are accepted by all twelve LVCs, but all except Webhuddle convert them to a proprietary format specific to the LVC application before displaying them. All applications except Netbriefings eConference Pro and Genesys Meeting Centre support a variety of content formats as well as slides: document formats such as PDF (.pdf) and Shockwave Flash (.swf), graphics formats like JPEG (.jpg) and GIF (.gif) and media formats like Windows Media Video (.wmv) and Audio Video Interleaved (.avi). Four of the twelve LVCs in the study (Interwise ECP Connect, Avacast Avacaster, Microsoft Livemeeting, and Genesys Meeting Centre) support animated content such as slide transitions. iLinc's LearnLinc and Adobe Breeze only support these through application sharing, and the other LVCs do not support them at all. All LVCs except Webhuddle support the spontaneous uploading of new content to the LVC during a class.

Slide shows are considered a necessary feature of any LVC to be selected for the Universities' use. They can be viewed as supporting an instructor-centred approach, but this is inaccurate; they are a tool and the manner and effectiveness of their use depends on the facilitator. To meet the Universities' needs, a LVC would have to support content of tertiary education level complexity, which frequently necessitates having some of the factual content written down for presentation to a class, both to structure the presentation and to enable participants to take notes easily. To be effective, slides need to be clearly visible to all participants. When the slide controller moves on to the next slide, the change needs to be reflected as close to immediately as possible for all those taking part in the class irrespective of location. Most LVCs surveyed allow content to be annotated (e.g. by highlighting words or figures, or drawing diagrams on a slide) and this would be a very useful feature in an academic environment.

5.2.5 Whiteboards

Whiteboards work similarly to the traditional paper flipchart. They allow the creation of notes, diagrams and drawings, and their functionality differs from one LVC to another. WebEx Training Centre, Genesys Meeting Centre and Webhuddle only allow

one person at a time to use the whiteboard tools. Interwise ECP Connect allows 2, and all other LVCs evaluated allow multiple users. All LVCs except Horizon Wimba's Live Classroom, WebEx Training Center, and Webhuddle, allow data on a whiteboard to be moved around once it has been entered. Eight of the twelve LVCs allow graphics to be cut from another application outside the LVC and pasted onto the whiteboard, and an equal number (although not corresponding LVCs) allow whiteboards to be saved and archived.

Whiteboards come equipped with a collection of tools, and most LVC applications provide very similar toolsets, as can be seen in the sample pictured in Figure 5.4. Most LVC applications provide a text typing tool, a pointer, a highlighter, some predefined shapes, a way to change writing colour, a freehand drawing tool such as a pen or pencil, and an eraser. Other possible tools include stamps, pointers in a range of shapes, selection tools akin to those in graphics packages (such as rectangles and smart selection wands), paintbrushes, paint spray cans, picture insertion tools, and extensions/options for the basic tools.

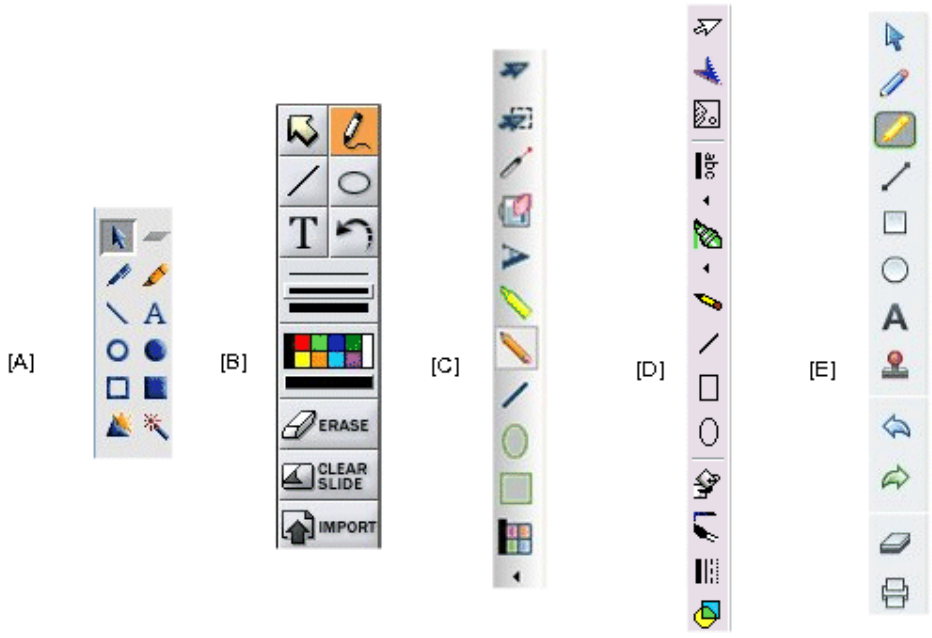

Figure 5.4 - A Sample of Whiteboard Toolsets in 5 LVCs ([A] Eluminate Live!, [B] Horizon Wimba Live, [C] HP Virtual Room, [D] iLinc LearnLinc, and [E] Adobe Breeze).

Pedagogically the whiteboard is one of the most collaborative tools available in a synchronous classroom (Hofmann, 2004: 60), and thus the inclusion of a whiteboard

is vital in any LVC application to be used by the Universities. Whiteboards are also valuable due to their appeal to a variety of learning styles (Hofmann, 2004: 60); visual learners appreciate the graphical aspect (colours, shapes, pictures), and kinaesthetic learners find the ability to physically interact with the tool (drawing, writing, highlighting) helps them to focus. Any whiteboard suitable for use by the Universities needs to include a mechanism to delete individual mistakes and to clear the whiteboard in its entirety when moving on to a new subject or exercise, and all whiteboards evaluated met this criterion. Once a whiteboard is loaded by a user it should appear on screen as close to immediately as possible for all persons taking part in the class. When it is unloaded, similarly, the change should be reflected, for every instance of the application (irrespective of the location of the participant), as close to immediately as possible. All participants should be allowed to make changes to the whiteboard (writing and drawing) in line with the principles of learner-centred, collaborative learning discussed in section 4.2.2 of Chapter 4.

5.2.6 Surveys/Polls

The ability to survey opinion has always been available in face-to-face classes by the simple expedient of asking participants to put up their hands or indicate their vote verbally. This can be achieved in the LVC by the inclusion of either specialised surveying/polling functionality (e.g. Figure 5.5), a mechanism for hand-raising or more simply, verbally over the audio. Surveys/Polls allow the facilitator to ask questions and get real-time feedback on issues. They can be very useful in assessing participants' feelings about an aspect of a course, or in ascertaining existing knowledge on a topic.

Different LVC applications offer different functionality when it comes to asking questions. Adobe Breeze and Microsoft Livemeeting only offer Multiple Choice Questions (MCQs), while others (e.g. Elluminate Live! and Genesys Meeting Centre) offer polls (in which the answers are represented as a bar chart or merely output as a percentage) as well as MCQs. Others (e.g. Horizon Wimba's Live Classroom and HP Virtual Rooms) offer the additional functionality to set up free-response questions. All LVCs that offer MCQs allow questions to be set up on demand, although Webhuddle's mechanism for achieving this can be unreliable.

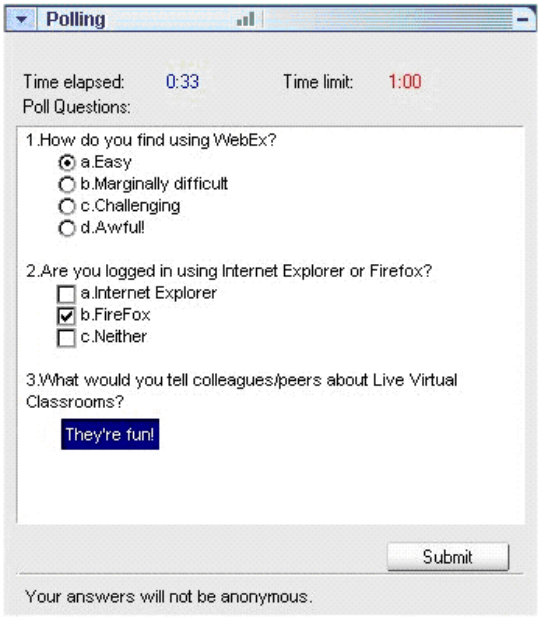

Figure 5.5 - A Poll Running in the WebEx Training Centre, Including Both MCQs and a Free Response Question

Most LVCs default to only allowing the facilitator to see the participants' answers associated with their names (i.e. who said what). In some classrooms, such as Interwise ECP Connect, Horizon Wimba's Live Classroom and Microsoft Livemeeting, who is allowed to see this information is configurable. All LVCs allowed survey/poll results to be shared with the class.

The complex surveying and polling tools available in commercial LVC applications are comprehensive, but are considered unnecessary in terms of the Universities' requirements for a simple system when the same results can be achieved by asking participants to raise a virtual hand (as described in section 5.2.7 of this chapter) or indicate their vote verbally. Anonymity in voting in this manner can be achieved by the use of the whiteboard (e.g. by participants placing a mark under columns headed 'for' or 'against'), but an open and collaborative environment in which participants felt comfortable to share and discuss their views would be preferable.

5.2.7 Participant Feedback Tools

Participant feedback tools allow participants personal feedback or interaction with the facilitator/class, such as the ability to raise a virtual hand (as can be seen included in each of the attendee list components in Figure 5.1) to ask a question or volunteer

information. They can also include tools to indicate participants' moods and opinions about the pace of the class, thus providing the facilitator with some of the affective feedback missing from most e-learning classes (Figure 5.6).

Figure 5.6 - Elluminate Live! Includes Participant Mood Indicator Icons as Well as the More Common "Hand-up" Button

Some applications include automatic feedback tools that give technical feedback on issues such as the quality of a participant's connection (latency and throughput) enabling the facilitator to gauge which participants might be experiencing problems participating fully in the class. These tools vary in complexity from very simple (Figure 5.7 [A]) to very comprehensive (Figure 5.7 [D]).

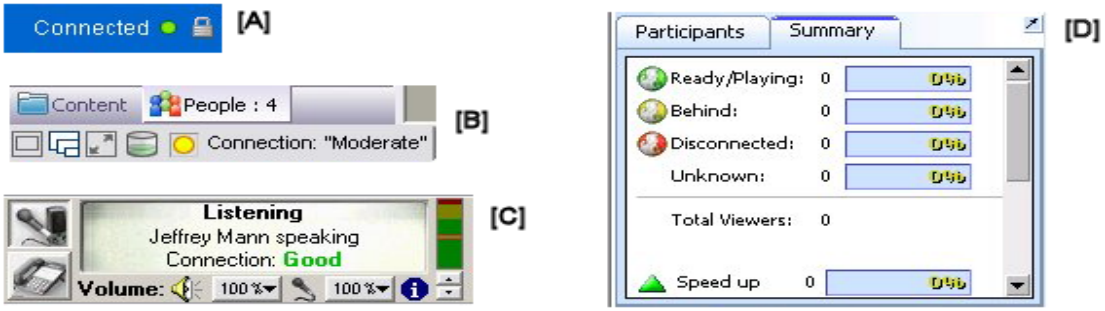

Figure 5.7 - A Comparison of Simple Connection Indicators in Four LVCS. (From Left to Right: WebEx Training Centre, HP Virtual Room, Interwise ECP Connect, and Genesys Meeting Centre.)

Technical feedback indicating the state of a participant's connection and details of the latency and throughput thereof, a hand raising mechanism, and feedback as to participants' moods or feelings about the e-class, are all features that could be valuable to the Universities. As with surveying and polling tools, however, these need to support an open and collaborative environment in which participants feel comfortable to share their views, as opposed to providing a way to criticise others or the class anonymously. Participant feedback tools would be a desirable, although not essential, feature of any LVC to be selected for the Universities' use.

5.2.8 Breakout Rooms

Breakout rooms allow participants to move into different virtual rooms (sometimes sharing a video display with separate audio, sometimes each with their own video and audio component) to facilitate small group discussions. Facilitators are usually able to move between these rooms at will. Seven of the LVCs evaluated (Horizon Wimba's Live Classroom, iLinc LearnLinc, HP Virtual Rooms, Elluminate Live!, Interwise ECP Connect, WebEx Training Center, Avacast Avacaster) have breakout room functionality. Some applications (e.g. Adobe Breeze) make use of a model in which all participants arrive in a main room or 'lobby' area and are moved into separate rooms from there (standard rooms are thus used to provide breakout room functionality). Six of the LVCs (Horizon Wimba's Live Classroom, iLinc LearnLinc, HP Virtual Rooms, Elluminate Live!, Interwise ECP Connect, and Adobe Breeze) allow the generation of a URL (a Uniform Resource Locator, commonly known as a web address) that will take participants directly to pre-assigned rooms. All of the applications providing specialised breakout rooms allow facilitators to move participants from room to room at will during a class. Whether or not materials (such as whiteboards) created in a breakout room can be brought back to the main room, or saved to be shared with others, is dependent on the application. The functionality to accomplish this is provided by all LVCs with breakout rooms except WebEx Training Center.

All the breakout rooms provided by the LVCs evaluated were designed for groups of participants that are large enough to make the ability to break out into smaller groups vital to facilitating discussion and interaction. In terms of the Universities' needs (a simple LVC for use by small educational groups) breakout rooms are thus considered unnecessary.

5.2.9 Live Video Transmission

Live video transmission provides valuable visual/non-verbal communication cues, such as tone of voice (also available from plain audio), facial expressions, and body language, that are otherwise absent from e-learning events. Eight of the LVCs evaluated (Horizon Wimba's Live Classroom, iLinc LearnLinc, HP Virtual Rooms, Elluminate Live!, Interwise ECP Connect, WebEx Training Center, Avacast

Avacaster, and Genesys Meeting Centre) provide video transmission functionality, which is usually used to broadcast video of the facilitator to the participants, providing a focus point for the class. Although live video transmission can also be used to show the participants to the facilitator or to the class as a whole (particularly useful when a participant is asking or answering a question), this is uncommon as a large number of video streams (which average 53 kbps for a single-stream live video feed) would raise the bandwidth requirements of a LVC considerably.

Although high quality video transmission of all participants would be ideal for the Universities' use, the bandwidth requirements make this option infeasible in practice. Capability for broadcasting video of the facilitator is considered a priority, and capability for broastcasting video of one selected participant at a time (e.g. to focus attention on a participant who is asking a question) would be advantageous. In the latter case, participants should be able to broadcast a stream and stop broadcasting it at will to allow another participant to do so; alternatively this could be under the control of the facilitator.

5.2.10 Application Sharing

All the LVCs evaluated offered application sharing functionality, allowing the facilitator to display software applications running on their own computer to participants inside the LVC. Participants may be able to interact with the shared application, depending on the LVC. Interaction usually involves passing control of the application to the participant for the time necessary for them to carry out the interaction. This means that the participant gains full mouse and keyboard control of that application for the duration granted to them. Application sharing usually allows for the selection of a single application to be shared, or multiple applications, or for the sharing of the facilitator's entire desktop. Some LVC applications show the shared application in the facilitator's view of the LVC (e.g. Adobe Breeze), which makes it easy to get some idea of what participants are seeing, while others simply show the facilitator an indication that an application is being shared (e.g. Horizon Wimba Live). Some applications allow participants to initiate application sharing instead of just facilitators, although this may necessitate their temporary promotion to a higher level of privilege.

Application sharing is a very powerful and valuable tool, and supports and facilitates collaboration and interactivity. It does, however, involve sending large quantities of graphical information from the originating computer to those of whoever is sharing the application(s) which makes it bandwidth intensive (ranging between 32 kbps and 512 kbps per application depending on the application itself) and slow. As such application sharing would be desirable if the bandwidth necessary to support it were available; until this becomes the case, the Universities would be unlikely to make much use of this feature.

5.2.11 Privilege Separation

Participants and facilitators usually have different levels of privilege in LVCs to allow facilitators greater access to an LVC's functionality than participants are granted. All LVCs evaluated have two levels of privilege (facilitator and participant) except for Horizon Wimba's Live Classroom, Interwise ECP Connect, Adobe Breeze and Genesys Meeting Centre which have three levels of privilege and include an administrator or super-user level which allows changes to be made to the set-up of the classroom and associated files. A moderator could be used in any of the LVC applications simply by giving a second person facilitator-level privileges. These privileges can also be granted to participants by promotion. Participants can either be spontaneously promoted by the facilitator and demoted again when necessary, or can log out of the LVC and log in again using a facilitator login. Most LVC applications make provision for facilitators to grant participants some extra functionality (the use of buttons or functions usually reserved for facilitators such as extra or more advanced whiteboard functions) without needing to promote them.

The idea that facilitators have full functionality whereas participants have little is more in keeping with traditional instructor-centred teaching and learning than the learner-centred approach supported by the Universities. Despite this, access to the full functionality of the LVC could prove confusing to participants who are not particularly computer literate or who are unfamiliar with the application. As such the functionality to allow participants automatic access to the functions that can be seen to directly contribute to interaction and collaborative learning (such as use of the audio

and text chat), and to functions necessary to control their classroom experience (such as the ability to check or set their connection speed), is considered important to the Universities. Other, possibly more administrative, functions can be hidden from participants by default, and the facilitator given the option to make these functions available to participants when appropriate. The guiding principle with respect to the suitability of a particular LVC's privilege separation policy is one of moving away from the role of the facilitator as an authoritarian in control of the class to a truly facilitative, guiding role. Microsoft LiveMeeting's privilege levels for participants are completely configurable and thus considered the best implementation of this feature.

5.2.12 Synchronised Web Browsing

Synchronised web browsing allows the facilitator to remotely open a webpage on every participant's computer at the same time. This is different from application sharing in that the browser application actually launches from the participants' own machines rather than being shared from the facilitator's machine. Once a page has opened, participants can be required to follow the facilitator's moves in browsing (i.e. their browser window stays in step with that of the facilitator, in a manner referred to as a 'web tour', as in Horizon Wimba's Live Classroom). Alternatively browsers can remain under the control of the participants so that they can browse from that point onwards in divergent directions if they so desire (as in HP Virtual Rooms). Some applications combine these modes: participants have browsing freedom until the facilitator chooses to move the class to a new page at which point their browsers follow suit (as in iLinc LearnLinc, Interwise ECP Connect, Avacast Avacaster, and Genesys Meeting Centre). URLs can often be entered into the classroom ahead of time (or at any point during the class) like bookmarks, for use whenever necessary (e.g. in Adobe Breeze).

Synchronised web browsing makes classroom control easier, but can encourage participants to be passive learners, sitting back while the facilitator makes the decisions. This is contrary to the pedagogical climate that the Universities are seeking to establish, and as such this feature is considered unnecessary. Participants will instead be encouraged to use their web browsers independently (e.g. to have a look at a website recommended by the facilitator or to find their own information), and to

develop their own individual responses. This presumes some degree of maturity and some desire to learn on the part of participants, but in doing so is in keeping with most location-independent and learner-centred teaching and learning. Synchronised web browsing is thus considered unnecessary, and even if present in a LVC, would be unlikely to be used by the Universities.

5.2.13 Recording and Archiving

Recording makes available any information missed in a LVC class for later reference. For informal sessions this means never having to lose an idea in a torrent of others. For more formal classes (which can be recorded and archived in DVD-like chapters) it means that participants can later refer to just what they need to know when they recall covering it in the class and realise they now need to apply it, making the class like a multimedia reference manual. It also enables participants who have missed a class to catch it up, provides an invaluable resource if material covered in the class needs to be revised, and allows classes to be shared at a later date.

All the LVCs surveyed allow a virtual class to be recorded. Recordings can be played back asynchronously and can sometimes be edited and polished into proper asynchronous lessons rather than simply a recording of a synchronous event (Hofmann, 2004: 25). What is actually recorded varies: it can be just the sequence of slides and files along with the voice component, or it can include text chat, or the proceedings in breakout sessions (Horton & Horton, 2003: 245). Approximately half of the LVCs evaluated (five out of twelve) record classes using a proprietary format of their own and thus the recordings require special software to play them back. Seven of the LVCs (Netbriefings eConference Pro, iLinc LearnLinc, HP Virtual Rooms, Interwise ECP Connect, WebEx Training Center, Avacast Avacaster, and Genesys Meeting Centre) allow recordings to be downloaded as a file to be played on a stand-alone computer, while other LVCs' recordings are only accessible over the web (streamed to a browser window), or recorded as a CD (for a fee) by hosting company.

The ability to record classes is a very valuable LVC feature, but is not vital to the Universities as the focus in selecting a LVC is on the synchronous features of the applications.

5.3 General Observations

Of the twelve LVC applications, seven were served from Europe/USA and hosted by their manufacturing company without the option of allowing the user to run the LVC application server locally. Accessing these from South Africa necessitates the use of international bandwidth which is expensive and also results in slower loading and response times. In the LVC assessment, the latter problem was noted to impact particularly on the use of VoIP, making the voice component of the LVCs generally unreliable, inconsistent and of poor quality. Server editions of LVC software, (available for iLinc LearnLinc, Adobe Breeze and Avacast Avacaster) cost significantly more than externally hosted editions. Webhuddle was available as a server edition at no cost, being freely downloadable from SourceForge.net, but was severely limited in functionality.

The LVCs surveyed were generally found to be enterprise solutions, catering more to the corporate market than to the educational market, and prices were prohibitively high when converted into South African Rand (averaging R67000 per year for a LVC that could accommodate ten people simultaneously). Despite many having the functionality (e.g. hand-raising systems) usually associated with Nantel's (2004: 2) "virtual classroom systems" category, they generally focused on the facilitation of business groups (Nantel's (2004: 2) "Web conferencing products" category) and commercial training (Nantel's (2004: 2) "live e-learning systems" category), and were unnecessarily complex for the Universities' requirements. Five of the applications required plugin software (some of which negatively affected the functionality of other pre-existing programs) to be downloaded and installed in order for them to work properly. Eleven of the commercial LVC solutions evaluated were proprietary, meaning that they can not be customised to meet the users' needs. Webhuddle was once again the exception, being open-source, but its limited functionality meant that it would require considerable further development before being comparable to the proprietary products.

5.4 Conclusion

Although LVCs are powerful synchronous e-learning tools and can offer many features that facilitate interactive, collaborative and engaging learning, none of the LVCs surveyed were ideal for the Universities' needs, due to a combination of factors including adaptability (ease of customisation), bandwidth requirements, complexity, business-focus, cost, and hosting location. A custom LVC application was thus deemed necessary to create a simple solution that would meet the requirements of Rhodes University and the University of Fort Hare both pedagogically and logistically. This custom solution would need to include all features identified as essential (Attendee Lists, Audio, Text Chat, Slide Shows, Whiteboards, Surveying/Polling functionality, Privilege Separation, Live Video Transmission) and as many as possible identified as desirable (Participant Feedback Tools, Application Sharing). Taken as a whole, the custom solution would need to provide the functionality to support the strongly interactive, learner-centred teaching and learning environment envisioned for the South African tertiary education environment.

Chapter 6 – Design and Implementation

6.1 Introduction

The evaluation of available LVC applications indicated a need for a custom LVC solution. The guiding principles underlying the design of the custom LVC were the need to allow the learning content to be transmitted more clearly and easily than was possible with the use of video-conferencing, the importance of establishing a sense of virtual presence, and the promotion of interactivity and collaboration amongst participants (in order to address the problem of participant disengagement experienced with the use of the earlier medium of video-conferencing).

The custom LVC would need to include areas for response and ways to involve participants by allowing and encouraging them to join in with their own input, as well as ways to indicate when participants have questions or problems (identified as important components in a Hitachi Data Systems study on best practice in LVC development (Howard: 2006, 15)). Research indicates that the use of audio, video, and graphics in web-based learning environments in general is greatly beneficial to students as it allows them to engage with instructional content in multiple ways (Dabbagh and Kitsantas, 2004: 41), and thus these elements were also considered important in the design of the custom LVC. The model would also need to focus on addressing the needs of an academic environment rather than a corporate environment (and be suitable for small group use), thus a smaller and simpler application than those surveyed was envisaged. Hardware and software used in the implementation of the proposed model, the user interface to the custom LVC, and the code written to achieve the necessary customisations to the default Flash Media Server 2 (FMS 2) components are also detailed in this chapter.

6.2 Features

Thirteen common LVC features were identified (section 5.2 of Chapter 5) and considered in terms of their functional and pedagogical value. Nine of these features were selected for inclusion in the custom LVC; the remaining four features were considered either unnecessary or impractical (Table 6.1).

Table 6.1 - Custom LVC Features

Feature	Motivation for Inclusion/Exclusion
Attendee Lists	Contribute to a sense of virtual presence
Audio	Contributes to a sense of virtual presence, promotes and facilitates interactivity and collaboration
Text Chat	Promotes and facilitates interactivity and collaboration, contributes to a sense of community, acts as an indicator of participant engagement
Slide Shows	Facilitate transmission of factual content
Whiteboards	Promote and facilitate interactivity and collaboration, appeal to a variety of learning styles
Surveys/Polls	Contribute to a sense of virtual presence, help facilitators to gauge participant responses, facilitate interactivity
Participant Feedback Tools	Enable participants to judge the quality of their connections, enable non-verbal communication with the facilitator
Privilege Separation	Allows participants to be empowered gradually, aiding and supporting those new to the virtual environment
Live Video Transmission	Promotes and facilitates interactivity, provides non-verbal cues, provides a focus point
Application Sharing	Impractical due to high bandwidth-requirements
Breakout Rooms	Unnecessary for small educational groups
Synchronised Web Browsing	Unnecessary and not pedagogically beneficial
Recording/Archiving	Valuable but unnecessary given the Universities' current needs

6.3 Requirements

The custom LVC needed to address the problems identified in existing LVC solutions in section 5.3 of Chapter 5. In order to achieve this, the application would need to:

- be servable from a local host, thus not requiring international bandwidth and improving the quality of VoIP and video transmission,
- be significantly more affordable than currently available LVC solutions whilst retaining the functionality that was identified as important,
- be customisable so that it can be adapted to respond to learners' and facilitators' changing needs, allowing new functionality to be developed and included and unpopular or unsuccessful features to be removed,

- require little in the way of hardware or software for the client - the final application should run in a web browser independent of operating system and without the installation of any unusual software plugins, and
- be simple to install and use.

6.4 Development Environment

The FMS 2 server was run on a Pentium 4 with a 2.8 Ghz processor and 2 Gb memory, running Windows Server 2003. Adobe Flash 8 Professional, the Adobe ActionScript scripting language, and Adobe FMS 2 were chosen for developing and serving the LVC application as they provided a solution that met the custom-LVC requirements and offered certain advantages over other development environments:

- The ActionScript scripting language is very similar to, and based on, ECMAScript[3] (more commonly known as JavaScript). JavaScript is widely used throughout the Internet and, in its ECMAScript form, is formally standardised. This makes transferring existing programming concepts to ActionScript much easier.
- FMS 2 provides a real-time communication server that facilitates the simple creation of networked applications. It can be installed on any machine running Windows Server 2003 (or RedHat Linux), and thus would allow any application developed in Flash to be served from either of the Universities.
- FMS 2 costs R26,220 (a once-off cost as opposed to the ongoing cost of using a commercial solution) and can support up to 100 users, making it significantly cheaper than purchasing a LVC solution (section 5.3 of Chapter 5).
- FMS 2 offers a library of customisable communication components that facilitate rapid application development and simplify the development of most of the desired features in the proposed LVC. Earlier versions of Flash and Flash Media Server form the basis of Adobe's commercial LVC solution, Breeze, which has been tried and tested with large corporate clients (Adobe, 2006b). It is also used in academic environments (e.g. it was used to give

[3] http://www.ecma-international.org/publications/standards/Ecma-262.htm

synchronous live virtual classes at the 2004[4] and 2006[5] e/merge e-learning conference) demonstrating the flexibility, reliability and power of flash.

- A LVC application developed in Flash requires nothing beyond a web browser with Flash Player to run on the client side. This means that the LVC application will run without requiring any other downloads or installations of software beyond Flash Player itself (which is already installed on 98% of desktops globally according to Adobe (2006a)), saving time and bandwidth and ensuring that the application will not interfere with any existing LVC software.

The application was initially coded in ActionScript 2 and published in Flash Player 8, but was changed to ActionScript 1 and Flash Player 6 when it became clear that the FMS 2 components required these settings to function optimally.

6.4.1 Flow of Control

A UML 2.0 (Object Management Group, 2006) activity diagram (Fowler, 2004: 117-130) indicates the flow of control through the LVC system (Figure 6.1). Users start off at a *login* interface (detailed in section 6.4.3 of this chapter) where they type in a password. This password is checked and if it is incorrect an error message is generated. If the password is not incorrect its status is checked and it is identified as either the facilitator or the participant password.

Users' privileges differ depending on whether they are logging in as a facilitator or as a participant. Facilitators can log in at any time (in order to allow them to check the classroom set-up, run through lessons, *etc*.) and thus if it is the facilitator password, the user is logged in straight away and presented with the *facilitator* interface (section 6.4.4 of this chapter).

[4] http://emerge2004.net/profile/abstract.php?resid=29
[5] http://emerge2006.net/profile/abstract.php?resid=28

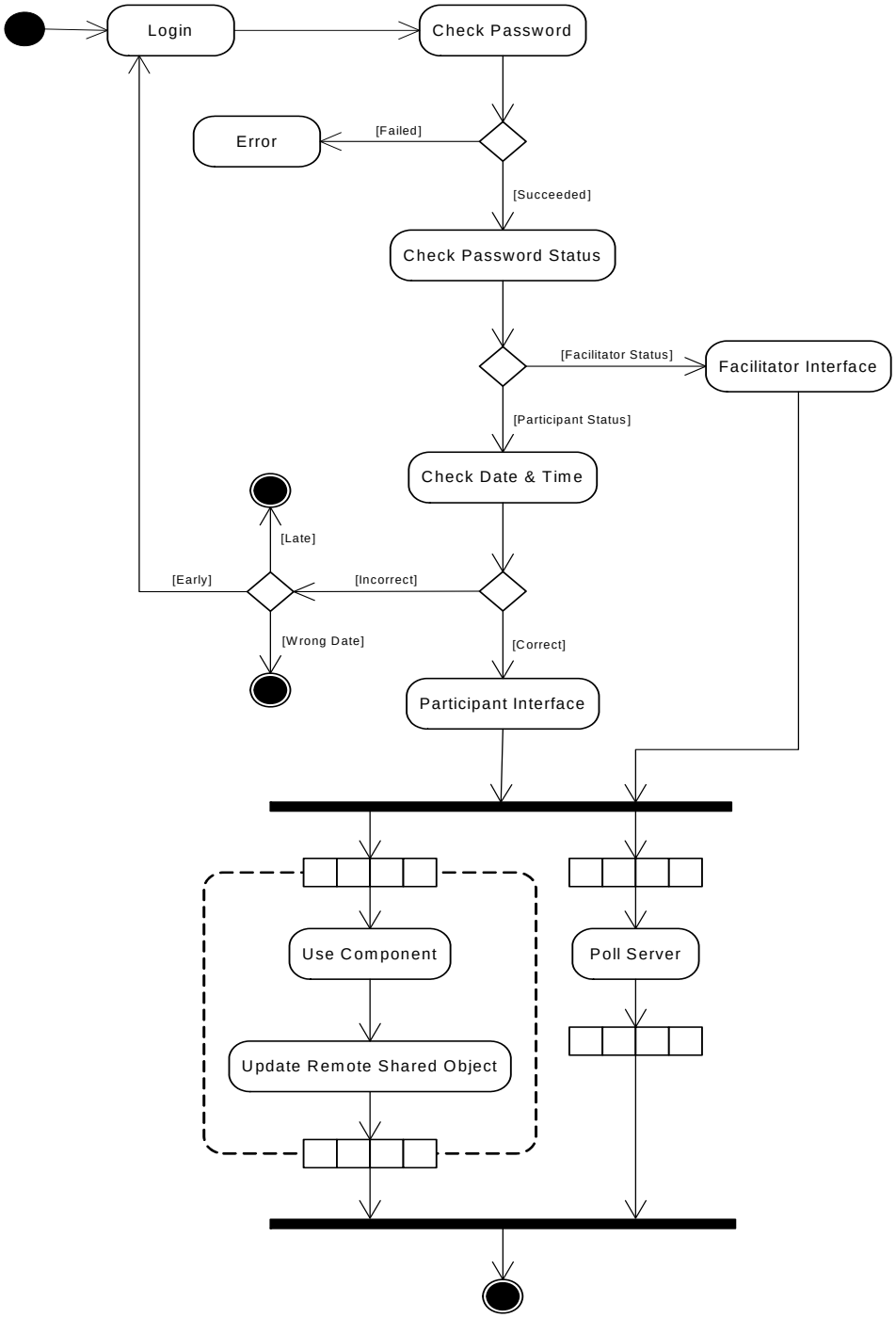

Figure 6.1 - LVC UML Activity Diagram

Participants can only log in ten minutes before a scheduled class on the date on which the class is scheduled, and after the class has officially ended they can not log in again until ten minutes before the beginning of the next scheduled class on the date on which that class is scheduled. If a user enters the participant password the date and time of the next scheduled class are thus checked. If they are late for the class they are

presented with the *late* interface (section 6.4.7 of this chapter); if they are early, they are presented with the *early* interface (section 6.4.6 of this chapter) and can press a button to return to the *login* interface. If the time is correct but there is no class scheduled for that particular day, they are presented with the *notToday* interface (section 6.4.8 of this chapter) indicating that they have attempted to log in on the wrong date. If the date and time are correct they are presented with the *participant* interface (section 6.4.5 of this chapter).

Once either the *facilitator* or *participant* interface has been loaded, all components can be used repeatedly until the user closes their browser window. Where the components are shared (e.g. the `WhiteBoard` , on which changes made by any user are reflected in every instance of the LVC, as opposed to the `UserColor` component, changes to which only affect the individual user of the component) any changes cause the component's remote shared object to be updated. Whether or not an instance of the LVC is being actively used, each instance polls the server repeatedly to detect any changes to components' remote shared objects (resulting from changes made to these by other users), and updates the shared components' displays accordingly.

6.4.2 LVC Application Interface Designs

The application is controlled by a Timeline (Figure 6.2) comprising four layers:

- a *label* layer to name and keep track of each interface,
- a *ui* (user interface) layer containing the interface elements,
- an *actions* layer containing the ActionScript for each interface,
- and a *logo* layer containing the logo element that is common to every interface.

A design decision was made to provide separate interfaces for *early*, *late*, and *notToday* instead of using one interface and changing it dynamically, as this allows for more complex extensions to these interfaces if further functionality is required from them in the future.

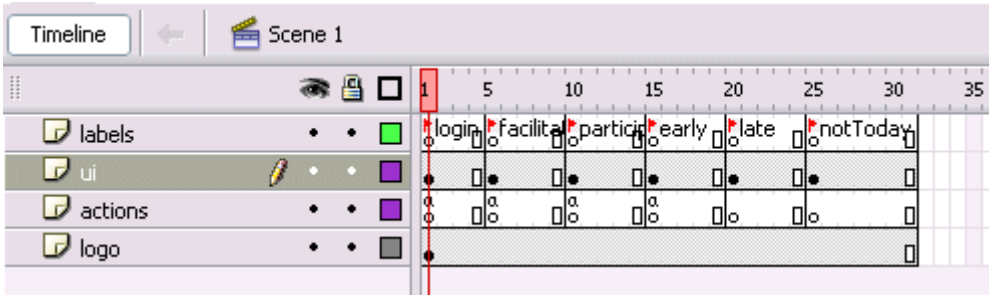

Figure 6.2 - The Completed LVC Timeline

6.4.3 The *login* Interface

The *login* interface (Figure 6.3) assesses a password entered and responds accordingly. It provides an `Input Text` box, and an `FCPushButton` to accept the password and respond to a mouse click or key press. A dynamic text box was placed above the password input text box to display an error message if the password is entered incorrectly. If the password is correct either the *facilitator* or the *participant* interface is loaded, depending on the password the user used to log in. Facilitators can log in at any time, but participants can only log in from ten minutes before a class is scheduled to start, and not afterwards.

Figure 6.3 - The *login* Interface

6.4.4 The *facilitator* Interface

The *facilitator* interface (Figure 6.4) is the facilitator's view of the LVC itself and offers complete control of the classroom. It comprises a number of FMS 2 components and four `FCPushButtons` (two to act as toggles for loading and unloading the whiteboard and the slide show, one for clearing the chat window and one to allow the facilitator to grant privileges to participants).

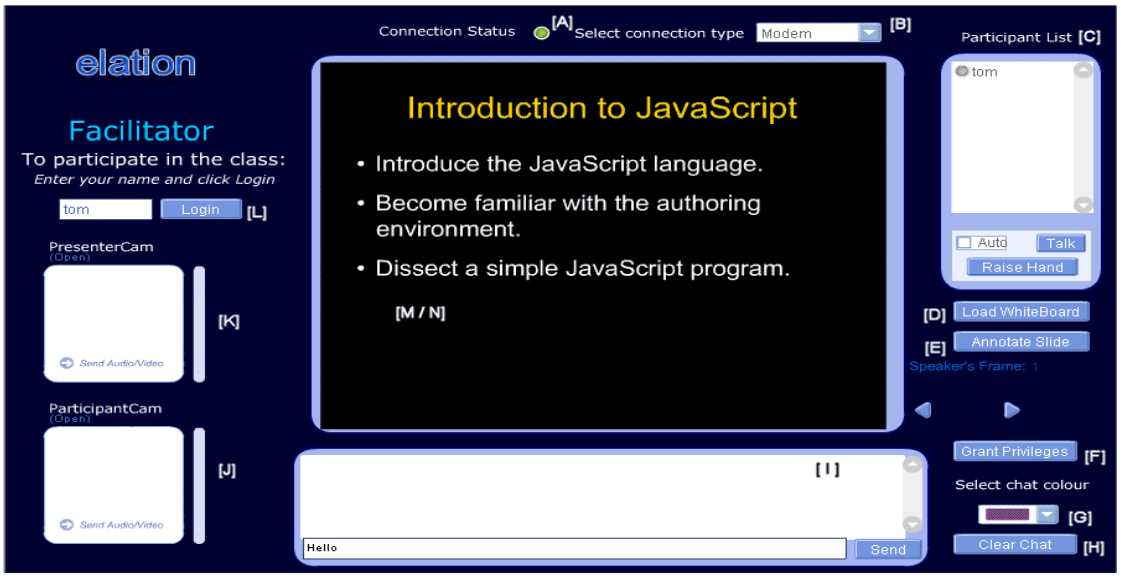

Figure 6.4 - The *facilitator* Interface, Including [A] a ConnectionLight Component, [B] a SetBandwidth Component, [C] an AudioConference Component , [D], [E], [F], [H] Four FCPushButtons, [G] a UserColor Component, [I] a Chat Component, [J] & [K] Two AVPresence Components, [L] a SimpleConnect Component, and [M] a WhiteBoard Component (Directly underneath [N] a PresentationSWF Component).

6.4.5 The *participant* Interface

The *participant* interface (Figure 6.5) is the participant's view of the LVC, and has slightly reduced functionality in comparison with the *facilitator* interface. It is set up similarly to the *facilitator* interface, except it includes only three `FCPushButtons` (the Grant Privileges button is excluded) which are initially set to be invisible in the student ActionScript. These buttons are thus are not present in Figure 6.5 which shows the default view of the *participant* interface. They can be enabled from the *facilitator* interface's Grant Privileges button.

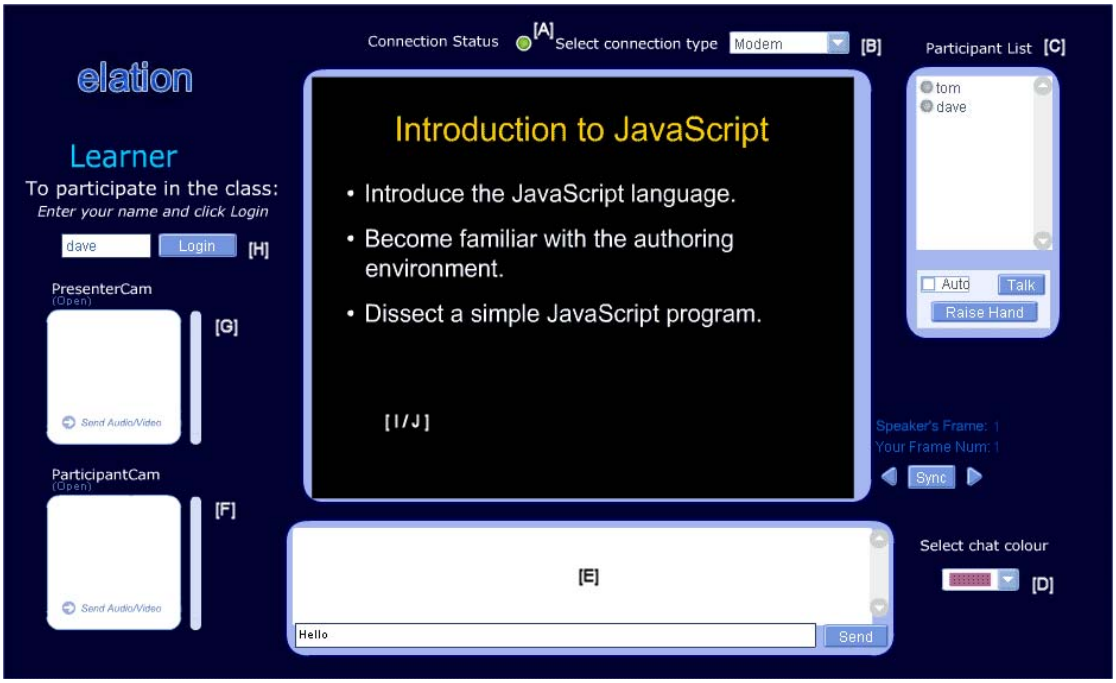

Figure 6.5 - The *participant* Interface, Including [A] a ConnectionLight Component, [B] a SetBandwidth Component, [C] an AudioConference Component , [D] a UserColor Component, [E] a Chat Component, [F] & [G] Two AVPresence Components, [H] a SimpleConnect Component, and [I] a WhiteBoard Component (Directly underneath [J] a PresentationSWF Component).

6.4.6 The *early* Interface

If participants are more than ten minutes early for a class the *early* interface (Figure 6.6) is loaded. It consists of a `Dynamic Text` box for displaying the scheduled class time which is extracted from a file that is updated for each new class booking. An `FCPushButton` to take the user back to the *login* interface is placed under the text boxes.

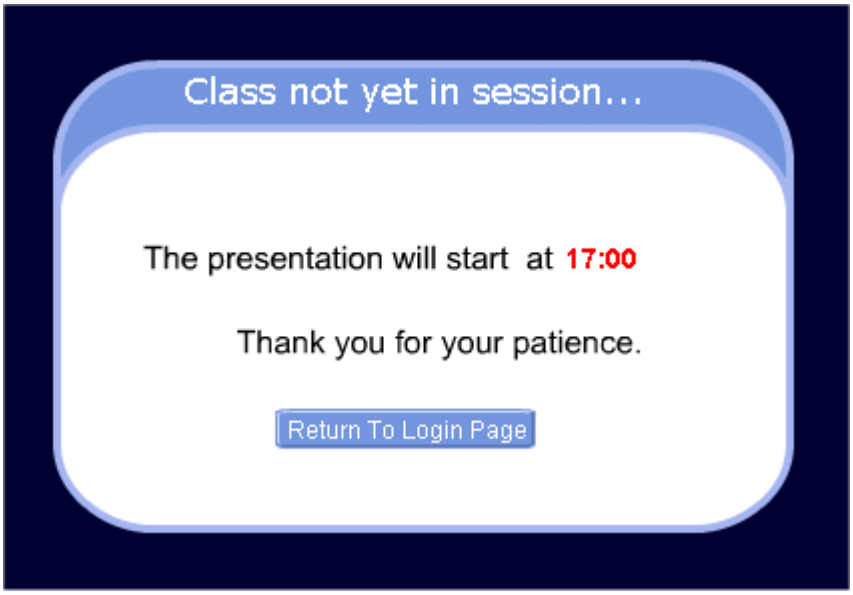

Figure 6.6 - The *early* Interface

6.4.7 The *late* Interface

If participants attempt to log in after a scheduled class has ended the *late* interface (Figure 6.7) is loaded. It provides a `Static Text` box with a message indicating that there is not a class scheduled for the current time.

Figure 6.7 - The *late* Interface

6.4.8 The *notToday* Interface

If participants attempt to log in when there is no scheduled class the *notToday* interface (Figure 6.8) is loaded. It provides a `Static Text` box with a message indicating that there is not a class scheduled for the current date.

Figure 6.8 - The *notToday* Interface

6.5 Application Development

A FMS 2 application comprises both server-side and client-side ActionScript. Very few changes needed to be made to the standard server-side code in the development of the custom LVC. On the client-side, ActionScript is associated with each keyframe (Figure 6.9) that demarcates the beginning of a new interface, and always begins with a `stop()` command to ensure that the movie does not play forward into the next keyframe without being specifically instructed to do so.

ActionScript is also associated with the specific components used in the various interfaces. Adobe's recommendation (Adobe, 2006c) was followed to keep ActionScript for buttons, textboxes and other UI components together with that for the keyframe of each interface, as opposed to associating it with the individual UI components.

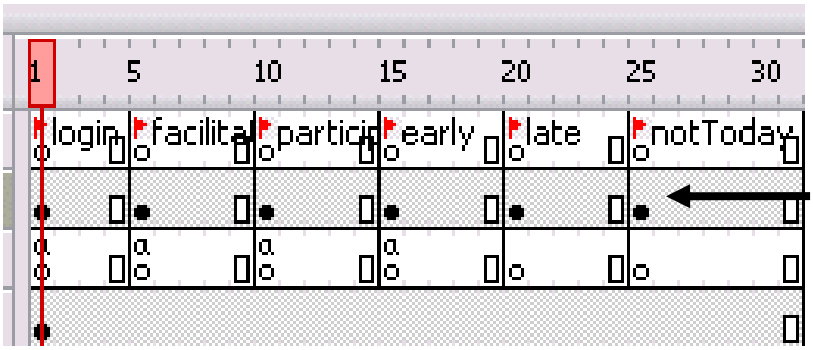

Figure 6.9 - Keyframes are Indicated by Black Dots (←) on the LVC Timeline

6.5.1 Setting Up the Server and Connecting the Client

FMS 2 was set up on the Windows Server 2003 server in accordance with the standard set up documentation provided. The client-side components were connected to the server using the `SimpleConnect` component which uses a GUI (Graphical User Interface) to add components that need to be connected (simply by adding them to its communication components list (Figure 6.10)), and manages the connection process transparently. The parameters tab of the `SimpleConnect` component on the *facilitator* and *participant* interfaces was configured to connect to the LVC application on the server (Figure 6.11).

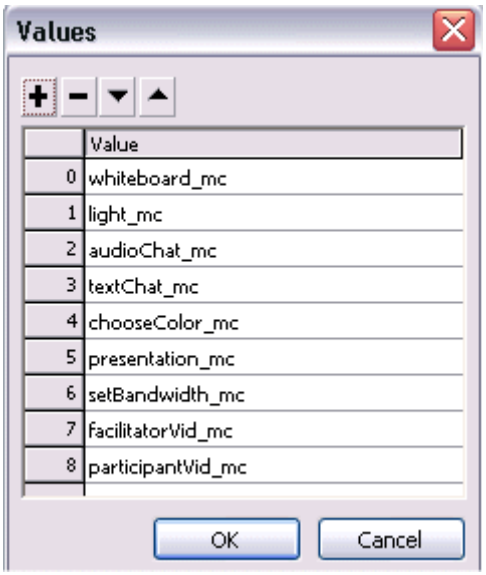

Figure 6.10 - The `SimpleConnect` Communication Components Dialog

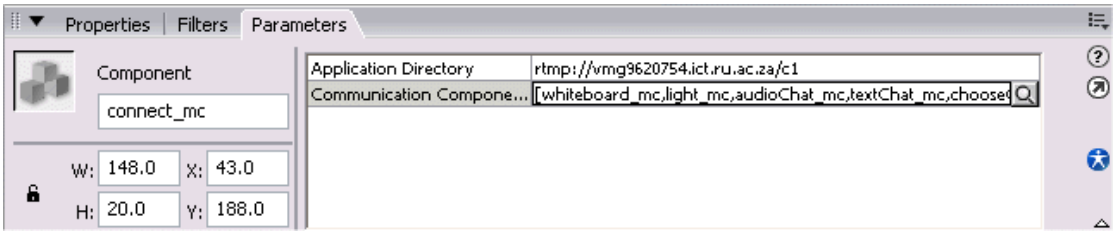

Figure 6.11 The `SimpleConnect` Component's Parameters

To be displayed in the classroom, slideshows need to be converted to Shockwave Flash files (.swf files, commonly referred to simply as Flash files or Flash movies). The slideshow file was placed on the server and the parameters tab of the `PresentationSWF` component was configured to point to it (Figure 6.12).

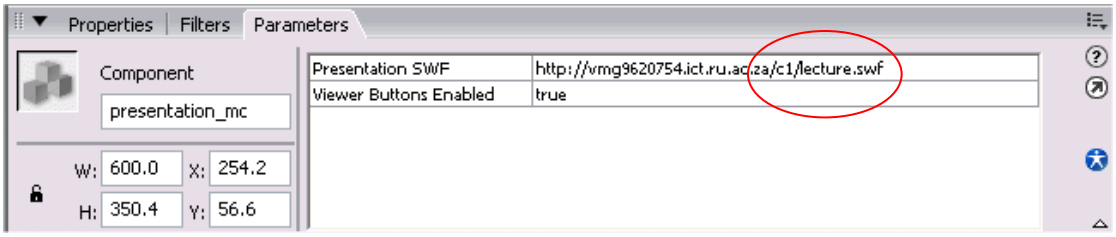

Figure 6.12 - The `PresentationSWF` Component's Parameters

6.5.2 Login Code

The very first interface is the *login* interface and its associated ActionScript controls every aspect of the process of logging in to the custom LVC. Initially the user's focus is set to the password input texbox. An `enterListener` is created for this textbox to allow the user to use the enter key as an alternative to the *Enter Room* button to progress to the next interface. Values are then loaded from the class set-up text file stored on the server and copied into local variables.

The ActionScript for the login button itself (the same code that is accessed by the `enterListener` if the user presses enter on the keyboard) determines the participants' role depending on the password they enter and loads the interface appropriate to this password as described in section 6.4.1 of this chapter.

6.6 Customisation

FMS 2 offered base components for six of the nine features identified as for inclusion in the proposed LVC (Attendee Lists, Audio, Text Chat, Slide Shows, Whiteboards and Live Video Transmission). Of these six, three components (Attendee Lists, Audio, and Live Video Transmission) already provided the functionality required but some customisation was necessary for the other three (Text Chat, Whiteboards, and Slide Shows).

The Universities' Text Chat needs are relatively simple, as mentioned previously (section 5.2.3 of Chapter 5): Text Chat should 1) allow both participants and facilitators to send and receive messages, 2) provide a way to identify the sender of a message, 3) store a chat history so that those joining the class late can catch up on the chat and anyone who is disconnected can, upon reconnecting, see what has occurred in the chat while they were offline, and 4) provide a mechanism to clear messages for privacy and in order to start afresh for a new class. Private messaging is unnecessary and could impact negatively on the open, communicative and collaborative atmosphere envisioned for the synchronous e-learning class. FMS 2's default Text Chat component (`Chat`) provides for requirements 1) and 2) and provides a simple way to implement 3), but makes no provision for 4), and thus this functionality needed to be developed.

FMS 2's default whiteboard component (`WhiteBoard`) allows all participants to make changes to the whiteboard (writing and drawing) in line with the principles of learner-centred, collaborative learning, and provides a mechanism to delete individual mistakes. It does not, however, provide the functionality to clear the whiteboard in its entirety when moving on to a new subject or exercise, and this needed to be developed. The default Slide Show (`PresentationSWF`) component fulfils all of the Universities' requirements (section 5.2.4 of Chapter 5) except for the functionality to allow content to be annotated (e.g. by highlighting words or figures, or drawing diagrams on a slide). This was achieved by making changes to the `WhiteBoard` component so as to leverage its full functionality for use in the annotation of slides. The remaining three desirable features (Surveys/Polls, Participant Feedback Tools and

Privilege Separation) did not have any standard components provided by FMS 2 for their development and needed to be developed from scratch.

Customising the default FMS 2 components proved more challenging than initially expected, as the code implementing them is very sparsely commented and thus it was not always clear what methods are expected to return and what parameters they should take. All customisations that were made, and any difficulties encountered in the process, are explained in detail in section 6.6.1 - 6.6.6 of this chapter.

6.6.1 Remote Shared Objects

Remote Shared Objects (RSOs) extend ActionScript to allow objects to be shared by many flash movies connected to a FMS 2 Media Server. As each instance of an application developed in Flash is effectively a movie, RSOs allow distinct instances of an application to communicate (Lesser, Guilizzoni, Lott, Reinhardt & Watkins, 2005: 281 – 296).

FMS 2 relies heavily on the use of RSOs to implement shared functionality such as allowing multiple users for games, text chat programs and shared virtual rooms. They are the means by which separate client instances of an application communicate with one another via the server. Many of the customisations effected to the FMS 2 components in the creation of the custom LVC, as well as much of the ActionScript written for the *facilitator* and *participant* interfaces, employed RSOs to achieve the desired functionality.

6.6.2 Clearing the Chat Window

The FMS 2 `Chat` component's default implementation does not provide a complete mechanism for clearing the text chat window. The possibility that this could be a requirement was envisaged in the creation of the FMS 2 components, however, and thus both the server-side and the client-side of the component include code that can easily be used by developers to implement this functionality.

6.6.2.1 Server-side Code

FMS 2 provides an `allowClear` variable (Listing 6.1) and a `clearHistory` function (Listing 6.2) in the `Chat` component's server-side chat.asc file. In order to implement clearing functionality this variable must be set to true.

```
FCChat.prototype.allowClear = true; // Allow clients to clear history
```

Listing 6.1- `Chat` Component Server-side Code

6.6.2.2 Client-side Code

The Chat component's client-side code provides a `clearHistory` function. A clear button (an `FCPushButton` called `clearChatBtn_mc` – Figure 6.4 (H)) was added to each of the client interfaces, and ActionScript to respond to the button by calling the client-side `clearHistory` function of the Chat component (`textChat_mc`) was added to the general ActionScript frame in both the *facilitator* and *participant* interfaces (Listing 6.2).

```
clearChatBtn_mc.onPress = function(){
                    textChat_mc.clearHistory(); //clear chat history
} //ActionScript to respond to FCPushButton
```

Listing 6.2 - Facilitator and Participant Client-side Code to Call the `Chat` Component's `clearHistory` Function

The *facilitator* interface allows the chat window to be cleared at any time using the clear button (`clearChatBtn_mc`). The *participant* interface only allows this when the facilitator grants privileges to participants, making the button visible on the *participant* interface.

6.6.3 Clearing the Whiteboard

The `WhiteBoard` component is present on both the *facilitator* and the *participant* interfaces. The changes explained in this section were made to the `WhiteBoard`

component itself to allow it to be added to each of the aforementioned interfaces without further coding being required for each interface.

The default `WhiteBoard` component allowed individual drawing elements to be highlighted on the board and deleted by pressing the delete key on the keyboard. There was no mechanism to clear the entire board at once, however. This necessitated wasting a lot of time cleaning the board for re-use. To add clearing functionality to the board no changes needed to be made to the server-side code. The client-side `WhiteBoard` component needed to have a clear button added to its interface.

The clear button (`clear_mc`) needed to be created to match the existing `WhiteBoard` component tool buttons. To do this, an existing tool button movieclip was extracted from the component library. The content of the icon layer was replaced with a new graphic developed using the Flash Integrated Development Enviroment's (IDE) graphics tools, a similarly styled movieclip button was created to perform the clear function, and imported into the library (into the **WhiteBoard Assets** folder with the other Whiteboard tool button movieclips).

The clear button then needed to be added to the `WhiteBoard` interface. This meant editing the interface for this component directly, which was challenging as changes made to the component's GUI are visible only when directly editing the component and on returning to the main stage in the IDE, the changes cease to be visible. When the ActionScript is compiled and run as a Flash movie (.swf) changes become visible again but can be slightly differently positioned to where they were placed when editing.

The default `WhiteBoard` component displays all of its tools on a toolbar. This toolbar was initially edited and extended to accommodate a new button. The clear button was added onto the toolbar component of the `WhiteBoard` interface and it was also coded into the WhiteBoard's array of tools, `toolList`, and made visible in the `showTools` function (Listing 6.3).

```
this.toolList = new Array("arrow_mc", "textBox_mc", "plainText_mc",
"line1_mc", "line2_mc", "line3_mc", "clear_mc");

function showTools(visible) {
      ...
      this.clear_mc._visible = visible;
      ...
}
```

Listing 6.3 - Adding the Clear Button to the List of Tools and Making it Visible

The clear button did not however appear on the toolbar at run-time. Removing the clear button from the toolbar component of the `WhiteBoard` interface and adding it to the base-level `WhiteBoard` interface did not solve the problem; the button did begin to appear at run-time but did not minimise with the rest of the tools on the toolbar. No other related code that could be controlling the visibility of the toolbar items could be found associated with the `WhiteBoard` component. No solution was found to this problem. The toolbar component was eventually removed completely and tools added individually, giving a working toolset of visible tools including the clear button.

The client-side WhiteBoard component now needed code to respond to the clear button by clearing the whiteboard. Shapes (lines and text are all considered shapes) drawn on the `WhiteBoard` in a particular instance of the application are reflected on the `WhiteBoard` in all other instances of the application. This is achieved by the use of a shared object. The shared object has a data array to store shapes that have been created. This array is checked every time a particular instance of the application synchronises with the server using the `onSynch` function (which occurs at regular intervals equal, by default, to the flash movie's frame rate) and any changes are reflected on that instance's `WhiteBoard`.

In order to completely clear the `WhiteBoard`, every shape stored in the shared object's array needs to be deleted and the shared object needs to be flushed. This was implemented as an `eraseBoard` function in the first `#initclip`[6] section of the

[6] The `initclip` pragma is used to specify that a block of code must run for a movieclip symbol before any instances of it are created, and allows initialisation to be performed for a movieclip . The number following `#initclip` allows multiple `initclip` blocks to be run in a specific order determined by their order integer (Moock, 2002, 549 - 551).

WhiteBoard component's client-side code with the rest of the WhiteBoard components' functions (Listing 6.4).

```
//clear whiteboard
FCWhiteBoardClass.prototype.eraseBoard = function() {
    for (var i in this.so.data) {
    delete (this.so.data[i]);
    }
    this.so.flush();
};
```

Listing 6.4 - The `eraseBoard` Function added to The `WhiteBoard` Component's Client-side Code

Finally, a handler for the clear button's click event was added in the handler area of the component to call `eraseBoard` when the clear button (`clear_mc`) was pressed (Listing 6.5). Any ActionScript functions that occur within the component code (but outside of the `initclip` pragma) and call methods defined within `initclip`, need to use `_parent` to achieve this. Although no compilation errors will result from omitting `_parent`, the method calls will have no effect at run-time.

```
this.clear_mc.onPress = function() {
      this._parent.eraseBoard();
};
```

Listing 6.5 - The Click Handler for the Clear Button

6.6.4 Loading/Unloading/Annotating the Whiteboard

The proposed LVC model included both whiteboard and slide show functionality. Initially a separate interface was planned to contain the `WhiteBoard`. However this presented problems. Firstly, to access the `WhiteBoard` everyone participating in a class would have to change interfaces, and this change would have to be initiated individually for each application. In order to return people to their correct interfaces afterwards (*facilitator* or *participant*) a mechanism would need to be put in place to track their interface of origin. Secondly, the ability to annotate slides (e.g. by highlighting words or figures, or drawing diagrams) was identified in the proposed model as a desired feature. The FMS 2 `PresentationSWF` component shows slide

presentations that have been converted into Flash files. No mechanism exists to annotate slides. The `WhiteBoard` component, however, already has a full set of tools for drawing and writing, including a colour palette, a mechanism for deleting individual drawing elements, and a customised mechanism for clearing the whole board. By changing the opacity of the `WhiteBoard`, it is possible to overlay it on a slide in a similar manner to an overhead projector transparency overlaid on a picture, and by this mechanism to effectively annotate the slide behind it. In order for this approach to annotation to work, both the `WhiteBoard` and `PresentationSWF` components needed to exist on both the *facilitator* and *participant* interfaces. All changes discussed here were coded in client-side ActionScript.

Two cases needed to be handled: 1) that of simply swapping the `PresentationSWF` component with the `WhiteBoard component` and back again, and 2) that of switching the annotation mode on and off. Two `FCPushButtons` were placed on the *facilitator* and *participant* interfaces to this end. Importantly, any changes effected to the slides or the whiteboard by the buttons needed to be reflected immediately in every instance of the LVC application that was running at the time, in order for the learning experience to be synchronous. This necessitated the use of RSOs.

RSOs are created using a static method of the SharedObject class, `SharedObject.getRemote()`. This method takes two parameters, a relative Uniform Resource Identifier or URI (the shared object's name) and a Real Time Messaging Protocol or RTMP address (the URI of the application instance) (Lesser, *et al.*, 2005: 284). The URI would thus be a `NetConnection` connected to the application instance. This could have been achieved by creating a new `NetConnection`, however the `SimpleConnect` component was already creating a `NetConnection` and it was decided that the neater and simpler solution would be to connect the shared object to this. Although `SimpleConnect` is responsible for connecting all other components (as seen in section 6.5.1 of this chapter), this was achieved by simply adding the component's names to the `SimpleConnect` component's connection list using a GUI dialog box which could not be used to connect the shared object. A look at the `SimpleConnect` component's code indicated that the `NetConnection` was called `main_nc`.

The first step in creating the RSO was thus to create a `NetConnection` variable and set it to point to the existing `NetConnection` using the name of the `SimpleConnect` component, `connect_mc` (Listing 6.6). This was placed inside a trace statement so that any error code returned would be viewable in the output window.

```
//setting client_nc to connect_mc.main_nc, SC's already-connected nc
trace(client_nc = connect_mc.main_nc);
```

Listing 6.6 - Connecting to the Existing `NetConnection` in ActionScript

This approach repeatedly failed to create a working connection, despite compiling perfectly. Investigation indicated that the ActionScript associated with a particular keyframe (in this case the keyframes demarcating the beginning of the *facilitator* and *participant* sections) is executed at run-time before the self-contained components are initialised. As such, when the attempt is made to connect `client_nc` to `SimpleConnect's main_nc`, the ActionScript to create a new `NetConnection` has not yet executed. In ActionScript 2 developers can specify when code is to run by setting the export frame for components in the ActionScript Publish Settings ActionScript 8 Settings dialog. The default FMS 2 components require ActionScript 1 and Flash Player 6. However (as mentioned in section 6.4 of this chapter), ActionScript 1 does not offer this option. The problem was solved by the placement of a second `SimpleConnect` component with the same name offstage on the *login* interface, allowing the `NetConnection` to be established before the user logs in and before the *facilitator* or *participant* interface is loaded.

Once the local `NetConnection` was successfully connected to the `SimpleConnect` component's `NetConnection`, a RSO was created (called `LVC_remote`, and using the `SimpleConnect` component's `NetConnection`), and was connected to the server by calling the shared object's `connect()` method and passing it a `NetConnection` object (Listing 6.7).

```
// Create a remote shared object
my_so = SharedObject.getRemote("LVC_remote", client_nc.uri);
// Connect to the shared object
my_so.connect(client_nc);
```

Listing 6.7 - Creating and Connecting the RSO

If the connection succeeds, the `SharedObject.connect()` method returns `true` and the server creates its own copy of the shared object if necessary (e.g. if no application instance of the LVC has connected before), or copies the contents of an already existing shared object to the local copy it has just connected. When the server's copy of the shared object is completely synchronised, the shared object's `onSync` method is called (Lesser *et al.*, 2005: 284). The `onSync` method (Listing 6.8) sets the application's shared properties to the value determined by their slot in the RSO (that controls and synchronises these properties across all instances of the application). It needs to be defined before it is called to ensure that no calls to this method are missed (Lesser *et al.*, 2005: 284).

```
// Update shared object slots
my_so.onSync = function(list) {
/*variables present in both the facilitator and participant
interfaces*/
      whiteboard_mc._visible = my_so.data.wb_visi;
      whiteboard_mc._alpha = my_so.data.wb_alpha;
      presentation_mc._visible = my_so.data.pres_visi;
/*extra variables present in the participant interface
ActionScript only to control the appearance and disappearance of
buttons when extra functionality is granted or removed */
      clearChatBtn_mc._visible= my_so.data.privs; //participant
      annotateSlideBtn_mc._visible= my_so.data.privs;
//participant
      loadWhiteboardBtn_mc._visible= my_so.data.privs;
//participant
      };
```

Listing 6.8- The Shared Object's onsynch Method

The ActionScript for the *facilitator* and *participant* interfaces creates and initialises six shared object slots (Listing 6.9). Note that the `onSync` method only includes cases where a property of a component in an interface is set to one of the shared object slot values, as these are the cases that need to be synchronised. Shared object slot values

can also be referenced directly without being included in the `onSync` method, as is clear in the manner of their initialisation.

```
//initialise shared object slot values
my_so.data.wb_visi = false;
my_so.data.wb_alpha = 100;
my_so.data.pres_visi = true;
my_so.data.wbModeFlag = false;
my_so.data.annotateModeFlag = false;
my_so.data.privs = false;
```

Listing 6.9 - Initialising Shared Object Slot Values

The whiteboard-loading button's `onPress` method (Listing 6.10) needed to handle three cases. In the first case, the user can only see the slide show - the whiteboard is invisible and slides are not being annotated (i.e. both the whiteboard mode flag (`wbModeFlag`) and the annotation flag (`annotateModeFlag`) slots of the shared object are set to false). Pressing the button thus ensures that the whiteboard is totally opaque, makes it visible, makes the slideshow invisible (effectively swapping the components), and keeps track of the fact that the LVC is now in whiteboard mode. Lastly the whiteboard-loading button's caption changes to indicate that pressing it again will return the user to the slideshow.

In the second case, the user can see the slide show although the whiteboard is visible because slides are being annotated (i.e. both the whiteboard mode flag (`wbModeFlag`) and the annotation flag (`annotateModeFlag`) slots of the shared object are set to true). Pressing the button at this point ensures that the whiteboard is totally opaque, makes it visible, makes the slideshow invisible (effectively swapping the components), and keeps track of the fact that the LVC is now back in whiteboard mode only and no longer in annotate mode. The whiteboard-loading button's caption changes to indicate that pressing it again will return the user to the slideshow, and the slide annotation button's caption changes to indicate that pressing it again will return the user to annotating slides.

In the third and last case the user can only see the whiteboard – the slide show is invisible and slides are not being annotated (i.e. the whiteboard mode flag (`wbModeFlag`) slot of the shared object is set to true, and the annotation flag

(annotateModeFlag) slot of the shared object is set to false). Pressing the button in this case ensures that the whiteboard is totally opaque in preparation for its next use, makes it invisible, makes the slideshow visible (effectively swapping the components again) and keeps track of the fact that the LVC is no longer in either whiteboard mode or annotate mode. Lastly the whiteboard-loading button's caption changes to indicate that pressing it again will once again load the whiteboard.

```
if (my_so.data.wb_visi !=true && my_so.data.annotateModeFlag
!=true){
      my_so.data.wb_alpha = 100;
      my_so.data.wb_visi = true; // make wb visible
      my_so.data.pres_visi = false; //hide presentation
      my_so.data.wbModeFlag = true; // note wb is visible
      loadWhiteboardBtn_mc.setLabel("Return to Slides");
      }
else if (my_so.data.wb_visi == true &&
my_so.data.annotateModeFlag == true){
      my_so.data.wb_alpha = 100;
      my_so.data.wb_visi = true; // make wb visible
      my_so.data.pres_visi = false; //hide presentation
      my_so.data.wbModeFlag = true; //note wb is visible
      my_so.data.annotateModeFlag = false;
      loadWhiteboardBtn_mc.setLabel("Return To Slides");
      annotateSlideBtn_mc.setLabel("Annotate Slide");
      }
else {
      my_so.data.wb_alpha = 100;
      my_so.data.wb_visi = false; //hide wb
      my_so.data.pres_visi = true; //make presentation visible
      my_so.data.wbModeFlag = false; //note wb is hidden
      my_so.data.annotateModeFlag = false;
      loadWhiteboardBtn_mc.setLabel("Load Whiteboard");
      }
```

Listing 6.10 - The `loadWhiteboardBtn_mc.onPress` Handler

The slide annotation button's onPress method (Listing 6.11) similarly needed to handle three cases. In the first case, the user can only see the slide show - the whiteboard is invisible, slides are not being annotated (i.e. both the whiteboard mode flag (wbModeFlag), and the annotation flag (annotateModeFlag) slots of the shared object are set to false). Pressing the button thus ensures that the whiteboard becomes partially transparent to show the slide show beneath it for annotation, and makes the whiteboard visible, leaving the slide show as it was before (visible). The annotation flag is used to keep track of the fact that the LVC is now in annotation mode. Lastly,

the slide annotation button's caption changes to indicate that pressing it again will return the user to the slideshow with no annotation visible.

In the second case, the user can not see the slide show because the whiteboard is visible and in use in normal whiteboard mode (i.e. the whiteboard mode flag (`wbModeFlag`) slot of the shared object is set to true although the annotation flag (`annotateModeFlag`) slot of the shared object is set to false). Pressing the button at this point makes the whiteboard partially transparent, makes it visible, and also makes the slideshow visible so that it can be annotated.

In the third and last case, the user can see the whiteboard and the slide show is visible, thus the slides are being annotated (i.e. the whiteboard mode flag (`wbModeFlag`) slot of the shared object is set to true, and the annotation flag (`annotateModeFlag`) slot of the shared object is set to true). Pressing the button in this case ensures that the whiteboard is totally opaque in preparation for its next use, makes it invisible, makes the slideshow visible (switching off annotation), and keeps track of the fact that the LVC is no longer in either whiteboard mode or annotate mode. Lastly, the annotation button's caption changes to indicate that pressing it again will once again allow slides to be annotated.

```
if (my_so.data.wb_visi !=true && my_so.data.wbModeFlag !=
true){
/*if wb is not visible / visi == null && we aren't in wb mode
(opaque whiteboard) i.e. if we can only see normal slides */

      my_so.data.wb_alpha=30; //make wb see-through to show
slide
      my_so.data.wb_visi=true; //now make wb visible
      my_so.data.annotateModeFlag = true; //note we are
annotating
      annotateSlideBtn_mc.setLabel("Remove Annotation");
      }
else if (my_so.data.wb_visi == true && my_so.data.wbModeFlag
== true){
/*if wb IS visible && we ARE in wb mode (opaque whiteboard)
i.e. we are just using wb as a WhiteBoard */
      my_so.data.wb_alpha=30; //make wb see-through to show
slides
      my_so.data.wb_visi=true; //now make wb visible
      my_so.data.pres_visi = true; //make presentation visible
      my_so.data.wbModeFlag = false;
      my_so.data.annotateModeFlag = true;
      loadWhiteboardBtn_mc.setLabel("Load Whiteboard");
      annotateSlideBtn_mc.setLabel("Return To Slides");
      }
else {
//wb is visible and we aren't in wb mode ie are in annotate
mode
      my_so.data.wb_visi = false;// hide whiteboard
      my_so.data.wb_alpha = 100; // set wb up to be opaque
again my_so.data.pres_visi = true; //make presentation visible
      my_so.data.annotateModeFlag = false;
      my_so.data.wbModeFlag = false;
      annotateSlideBtn_mc.setLabel("Annotate Slides");
      }
}
```

Listing 6.11 - The `annotateSlideBtn_mc.onPress` Handler

6.6.5 Privilege Separation

Privilege separation allows facilitators access to more aspects of a LVC's functionality than is provided to the participants (section 5.2.11 of Chapter 5). The proposed model identifies the benefit of supporting a range of levels of authoritarianism, enabling facilitators to give participants an increasingly active role in classes as they become familiar and comfortable with the technology. This requires the implementation of functionality to allow facilitators to grant privileges to participants beyond those they are granted by default.

Privilege separation is achieved using RSOs. One of the shared object slots identified earlier, `my_so.data.privs`, is set to `true` or `false` to keep track of whether or not full functionality privileges have been granted to participants. In the *facilitator* interface all functionality is present by default and can not be taken away. In the *participant* interface (inside the shared object's `onSync` function) the buttons to clear the text chat window and the toggle buttons for using the whiteboard and switching annotate mode on and off are set to the current value of `my_so.data.privs` (Listing 6.12).

```
// Update shared object slots
my_so.onSync = function(list) {
      ...
      clearChatBtn_mc._visible= my_so.data.privs; //participant
      annotateSlideBtn_mc._visible= my_so.data.privs; //participant
      loadWhiteboardBtn_mc._visible= my_so.data.privs;
//participant
      };
```

Listing 6.12 -The Shared Object's onSync Method

The ActionScript to respond to the privilege-granting button (`grantPrivsBtn_mc`) simply changes the value of `my_so.data.privs` and relies on the shared object's `onSync` function to effect the changes to the visibility (and thus accessibility) properties of the relevant tools (Listing 6.13).

```
grantPrivsBtn_mc.onPress = function(){
                  if (my_so.data.privs != true){
                        my_so.data.privs = true;
                  }else {
                        my_so.data.privs = false;
                  }
}
```

Listing 6.13 - The `onPress` Handler for the `grantPrivsBtn_mc` Button

6.6.6 Customising The Audio Conference Component

A hand-raising function was identified in the proposed model as a valuable tool to include, both in terms of its ability to allow participants to provide feedback and in terms of its ability to provide simple polling functionality.

6.6.6.1 Hand-raising Function

The `AudioConference` component is present on both the *facilitator* and the *participant* interfaces. As with the customisation of the `WhiteBoard` component, the changes explained in this section were made to the `AudioConference` component itself to allow it to be added to each of the aforementioned interfaces without further coding being required for each interface.

The default `AudioConference` component shows a list of all logged-in participants and provides indicator light icons next to each name in the list. The icons are grey (the lights' `off` state) until a particular participant speaks, whereupon they turn bright green, appearing to switch on. This mechanism was customised to include a button to allow participants to raise their hands, indicating this by displaying a red light icon next to their name in every instance of the LVC application (Figure 6.12).

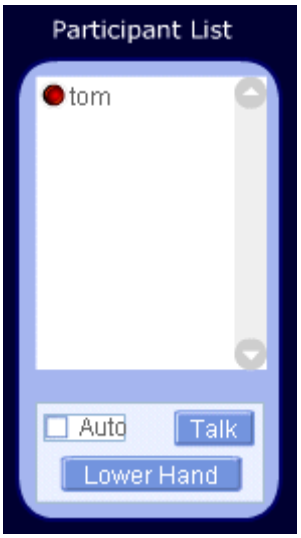

Figure 6.13 - The `AudioConference` Component Showing a Participant with Their Hand Raised.

The indicator lights are icons on separate frames of a small movie clip, each showing the light in a different state. The grey `off` light icon is on frame two layer one, and the green on light icon is on frame three layer one. A fourth frame was added to each layer and a red `raised hand` icon was created and placed on frame four layer one (Figure 6.14 overleaf).

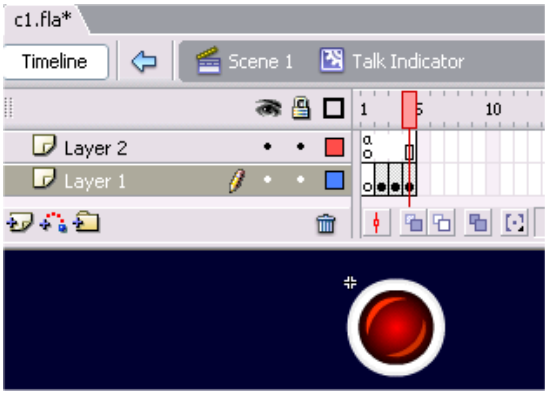

Figure 6.14 - The `light_mc` Movieclip Showing The "Raised Hand" Light Icon (Frame Four)

A look at the ActionScript for the `FCAudioConferenceClass` shows that the `startStream` function (Listing 6.14) handles the automatic audio detection while the `pttPress` and `pttRelease` functions (Listing 6.15) handle the manual pressing and releasing of the talk button. These functions also appear to handle the appearance of the indicator light by determining the frame on which the `light_mc` movieclip stops.

```
FCAudioConferenceClass.prototype.startStream = function(ID) {
      ...
      this.audioOwner.so.data[this.audioOwner.userID][1] = true;
      this.audioOwner.localAudio_mc.light_mc.gotoAndStop(2);
            } else {
                  //trace("Auto Quiet");
      this.audioOwner.so.data[this.audioOwner.userID][1] = false;
      this.audioOwner.localAudio_mc.light_mc.gotoAndStop(1);
            }
            }
      };
```

Listing 6.14 - The `startStream` Function in the `FCAudioConferenceClass`

```
FCAudioConferenceClass.prototype.pttPress = function() {
            ...
            this.so.data[this.userID][1] = true;
            this.localAudio_mc.light_mc.gotoAndStop(2);
      }
};
//
FCAudioConferenceClass.prototype.pttRelease = function() {
      if (!this.auto) {
            this.talking = false;
            this.streamOut_ns.attachAudio(null);
            this.so.data[this.userID][1] = false;
            this.localAudio_mc.light_mc.gotoAndStop(1);
      }
};
```

Listing 6.15 -The `pttPress` and `pttRelease` Functions in the `FCAudioConferenceClass`

However, the frames to which this code refers are incorrect – the frame numbers of the `light_mc` movieclip did not correspond to the correctly coloured indicator icons and did not reflect the behaviour of the component when the application ran. Changing the frame numbers had no effect. Trace statements were placed inside the `startStream`, `pttPress` and `pttRelease` functions and confirmed that they were in fact being run as expected, however when the lines of code emphasised in the listings were commented out completely the application continued to run perfectly. The code clearly did not do what it appeared to do, and thorough investigation revealed that it in fact had no function whatsoever. This begged the question of what was actually controlling the indicator light icons.

Investigation revealed the answer to be the `FCAudioConferenceItem` class (`#initclip 3`). Which icon displays at a given time is determined by the `displayContent` function (Listing 6.16) inherited from the `FSelectableIcon` class (`#initclip 2`). This function accepts two parameters, an item object (`itmObj`) and a selected variable (`selected`).

```
FCAudioConferenceItemClass.prototype.displayContent =
function(itmObj, selected) {
      super.displayContent(itmObj, selected);
      if (itmObj.data == "on") {
            this.light_mc.gotoAndStop(3);
            } else if (itmObj.data == "off") {
            this.light_mc.gotoAndStop(2);
            } else if (itmObj.data == "up"){
            //extra section added
            this.light_mc.gotoAndStop(4);
            } else {
            this.light_mc.gotoAndStop(1);
            }
};
```

Listing 6.16 - The `FCAudioConferenceItemClass`'s `displayContent` Function

The `itmObj` parameter contains the `label` property and the `data` property of the item object that were set when the item was added to the `audio_lb` listbox with the `addItem` function. Item objects were added to the list box in the `FCAudioConferenceClass's` ActionScript inside the shared object's `onSynch` function, and given a value of `on` if the data in the shared object associated with the item's name is set to true, and a value of `off` if not (Listing 6.17).

```
this.so.onSync = function(list) {
      ...
      for (var n in this.data) {
            this.total++;
            this.owner.audio_lb.addItem(this.data[n][0],
this.data[n][1] == true ? "on" : "off");
            }
      ...
}
```

Listing 6.17 - The Default `AudioConference` Component's onSynch Function before Customisation

In the `FCAudioConferenceItemClass's displayContent` function, the `data` property of the item object was examined and the indicator light movie clip advanced to the correct frame to represent whether the light was `on` or `off` (Listing 6.16). The stock component was thus set up to only ever handle two states for the light. Adding a third state required creating a new variable (`tempItmObj`) to hold the value that needed to be passed in as the `data` property of the list box `AddItem` method. The

conditional statement determining the value of the `data` property also needed to be rewritten to handle the four possible necessary cases (`true`, `false`, `up`, and anything else) (Listing 6.18).

```
this.so.onSync = function(list) {
      ...
      for (var n in this.data) {
                  this.total++;
                  var tempItmObj;
                  if (this.data[n][1] == true){
                        tempItmObj = "on";
                  }else if (this.data[n][1] == false){
                        tempItmObj= "off";
                  } else if (this.data[n][1] == "up"){
                        tempItmObj = "up";
                  } else {
                        this.data[n][1] == undefined;
                  }
            this.owner.audio_lb.addItem(this.data[n][0],
tempItmObj);
      }
      ...
}
```

Listing 6.18 - The `AudioConference` Component's onSynch Function after Customisation

In the `FCAudioConferenceItemClass` code was added to respond to the `up` state by advancing the movie clip to the frame containing the red raised-hand indicator light (Listing 6.16).

A `handUp` function (Listing 6.19) was added within the `#initclip 1` of the `AudionConference` component to toggle the shared object's `data` property for the application instance's logged-in user between `up` (the red indicator icon) and `false` (the default, grey, indicator icon).

```
FCAudioConferenceClass.prototype.handUp = function() {
            if(this.so.data[this.userID][1] == "up"){
                  this.so.data[this.userID][1] = false;
            } else {
                  this.so.data[this.userID][1] = "up";
            }
};
```

Listing 6.19 - The handUp Function Added to the AudioConference Component

Finally the user interface of the AudioConference class was edited to include a 'Raise Hand' button (raiseHandBtn_mc). This was more complex than expected because, as with the WhiteBoard, changes made to the component's GUI are visible only when directly editing the component. On returning to the main stage in the IDE the changes cease to be visible. When the ActionScript was compiled and run as a Flash movie changes became visible again but in this case, unlike that of the WhiteBoard, the placement of the new items in the edited component's GUI was slightly different to how it appeared when it was being edited. Changes thus had to be made, the application run, the offset noted, the application stopped and edited again and then run again, repeatedly, until the desired effect was achieved.

ActionScript to respond to the "Raise Hand" button was written in the FCAudioConferenceClass (outside #initclip 1) to call the handUp function as shown in Listing 6.20.

```
this.raiseHandBtn_mc.onPress = function() {
      trace("raise hand btn");
      this._parent.handUp();
      if (raiseHandBtn_mc.getLabel() == "Raise Hand"){
            raiseHandBtn_mc.setLabel("Lower Hand")
      }else{
            raiseHandBtn_mc.setLabel("Raise Hand")
      }
};
```

Listing 6.20 - The raiseHandBtn_mc Click Handler

6.7 Conclusion

The Flash development environment complicated the process of customising FMS 2's default components on a number of occasions due to changes in the appearance of

components in between the editing mode and the main stage in the IDE, leading to inappropriate results when the Flash movie was played. Customisation itself was also challenging on occasion due to a paucity of detailed documentation, and to misleading extraneous code within the `AudioConference` component that was not tidied up by the developers after ceasing to have any function.

Despite these difficulties, developing the custom LVC application was relatively simple on the whole, and should be well within the reach of Computer Science departments or Information Technology divisions at most universities.

Chapter 7 – Evaluation

7.1 Introduction

Once the LVC had been created, a pilot study was carried out to check that the application would run as expected, and to attempt to identify any technical problems that might need to be addressed, before the software was evaluated. Thereafter a trial learning event was held in the LVC, and detailed feedback gathered from the class participants.

7.2 Pilot Study

The pilot study was carried out with a group of six participants, all of whom were post-graduate students and had had some experience with the previous video-conferencing system, making them familiar with common distance-learning problems. It aimed to establish the technical reliability of both the LVC and the associated equipment used to take part in LVC classes, including headsets, microphones, speakers and webcams, and also to see if any other unforeseen major issues would arise that might need to be addressed before formal evaluation could commence. Hardware provided for the pilot study matched what was to be used in the final deployment environment: participants all had a networked PC (with a 1.86 GHz Intel Core Duo processor, 2 GB RAM , and on board audio and video cards) connected to the Computer Science and Information Systems departments' 100 mbps switched Local Area Network (LAN). These ran Windows XP as their operating system and offered Mozilla Firefox (version 2) and Microsoft Internet Explorer (version 7) as web browsers. Participants were provided with a Logitech Premium Stereo USB headset (incorporating a microphone), and a Logitech QuickCam Chat webcam, and were provided with private rooms where they would not be disturbed during the testing. A short class (consisting of a presentation and a group task) was given to the participants. Data was gathered on practical issues arising during the pilot study by means of the collection of written post-test feedback from participants covering topics such as the technological difficulties experienced, user perceptions, and general impressions.

7.2.1 Pilot Study Results and Discussion

Participants reported finding the process of setting up for the pilot test simple, although the installation and setup of the webcams and microphones was not considered intuitive and presented some difficulties. The integrity and quality of the video stream in the LVC class was considered of acceptable quality, as was that of the audio stream. Problems were experienced with audio echoes and feedback which made it very difficult to hear some participants. The degree of synchronisation between visuals and audio was rated highly, and video latency was not considered to be a problem. The slides in the LVC were reported to be both suitably clear and readable, and an improvement on the clarity and readability of slides transmitted in video-conferencing classes.

Certain difficulties experienced by new users became apparent during the pilot study. A participant indicated that interaction with other participants and the facilitator was easier using video-conferencing than in the LVC, commenting that using video-conferencing they could “just talk” whereas in the LVC “the talk button had to be pressed to talk”. This is not the case; the participant had not understood that they needed only to click once at the start of the class on a check box provided as part of the `AudioConference` component, in order to have their audio input automatically detected without the need to press a button. A participant also found the buttons in the LVC distracting and reported not feeling comfortable interacting with others via a virtual environment. The interface was considered acceptable by the other testing participants and the technology was considered likely to be able to support interactive classes by the use of the tools provided.

The pilot study indicated that the LVC application was technically sound. Minor difficulties experienced by participants in setting up for the class (e.g. in setting up the cameras and microphones) could safely be ascribed to a lack of familiarity. Such difficulties are likely to fall away in a real course situation (Johansson *et al*., 2005) as participants will use the LVC on more than one occasion, gaining experience with practice. Hardware (webcams and microphones) should also only need to be installed for the first class, after which they can simply be used in the same manner as any other hardware peripherals. The audio issues were investigated and determined to

have been the result of one of two separate causes: either participants were using speakers (instead of headphones) which created feedback loops with their microphone input, or they had two active sources of audio input running simultaneously (e.g. headset-microphones and webcam-microphones). Changes to the application itself were thus unnecessary to solve these problems, which were addressed by configuring the peripheral devices' hardware and software correctly. Confusion experienced by one participant about the specifics of the tool options indicated a need for time to be allocated at the beginning of a class for familiarising participants with the classroom and explaining the tools' functions. As it is unlikely that all synchronous e-learning class participants will automatically feel comfortable in the environment, the fact that a participant in the pilot study reacted by finding the LVC to be alien and uncomfortable for them on first using it was considered unlikely to indicate a technological problem. Whether this was indicative of a user interface design flaw could be better determined during the trial learning event held during the final evaluation phase of the project.

7.3 Final Evaluation

Once the audio problems had been solved and the LVC was established to be technically sound, testing was carried out to determine how it performed in a real classroom situation.

7.3.1 Aims and Methodology

The aim of the evaluation class was to trial the custom LVC software in a realistic learning situation, and note how it performed based on feedback from those involved. For it to provide a viable alternative to the original video-conferencing system, the LVC needed to enable the facilitator to run a class that avoided the problems experienced with video-conferencing (Chapter 2). Its pedagogically informed features also needed to provide support for updated teaching and learning needs (Chapter 4). In general the LVC needed to be proved to be an environment capable of facilitating interactive, collaborative and engaging learning for a small group of participants joining in from a number of separate locations.

The evaluation class was carried out with eleven participants, a typical size for an honours/fourth year level course module, and a size it was hoped with would be conducive to interactivity. All participants were post-graduate students. The class was facilitated by a lecturer in the Information Systems department who is carrying out ongoing research on both synchronous and asynchronous e-learning, and runs the Information Systems honours e-learning course module. The facilitator had experienced a class in a LVC from the facilitator's point of view on a previous occasion (2004), and had been involved on a number of occasions as a participant. A class of an hour's duration was designed, presenting the contents of a paper relevant to the e-learning course module. This was carried out in as interactive a manner as possible, encouraging input and discussion amongst the participants via all the available communication channels of the LVC (text chat, whiteboard, VoIP, video transmission and the hand-raising function). Participants logged in to the LVC (Figure 7.1) at a prearranged time and all set their connection type to LAN. The slide show facility was preloaded with the slides for the seminar.

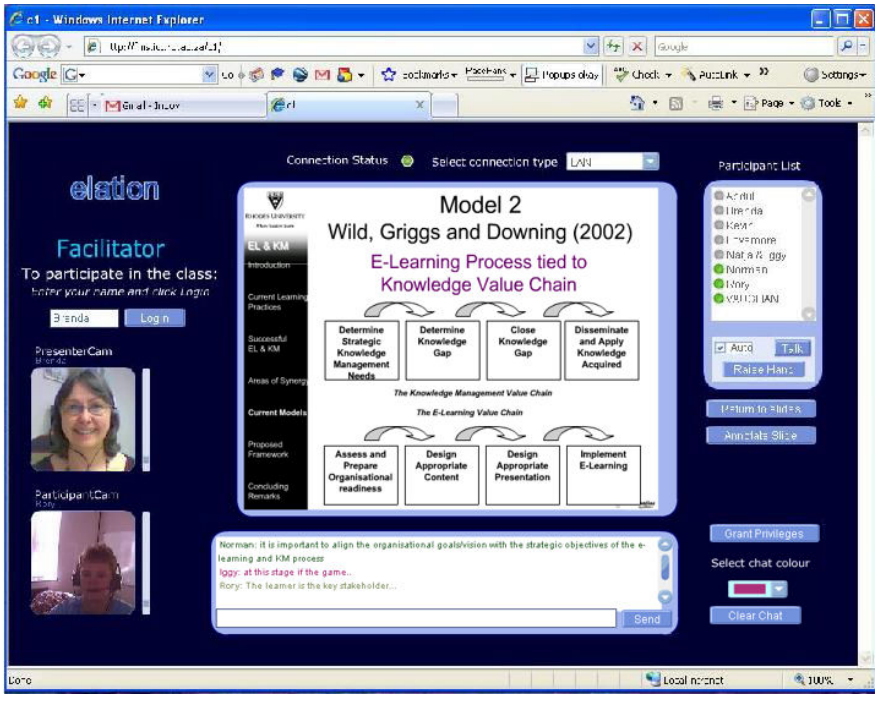

Figure 7.1 - The LVC in Use During the Class, Showing Both the Facilitator and a Participant Using the Video Transmission Tools. Participants Who are Broadcasting Audio All Have the Indicator Light Next to their Names in the Attendee List Coloured Green.

The whiteboard facility was used to display a welcome message to the participants as they entered the class (Figure 7.2). Other than this, the whiteboard was not heavily used in the evaluation class, except in annotation mode to overlay the slides (in which capacity it was frequently useful for the annotation of slides).

Figure 7.2 - Whiteboard Welcome Message

The attendee list displayed all those currently logged in to the class and was used to keep track of who was in attendance at any given time. The facilitator intended to use the hand-raising functionality to poll opinions but later reported (B. Mallinson, 2007, pers. comm., 12 September) regret at having forgotten to include this during the class.

Extensive use was made of the VoIP audio. Video transmission was used less frequently, displayed in the LVC's facilitator camera to emphasise particular points or when appropriate to improve communication with the class. Still images of the facilitator were used in this camera window the rest of the time. Participants were encouraged to activate and use the application's participant camera tool, both when they were speaking and at any other time they felt they would like to do so during the class. All participants with webcams were given the opportunity to transmit video to the class using the participant camera tool. The text chat was used both by the facilitator and by the participants, to highlight points discussed over the audio, ask questions or ask for help, and offer insights, opinions, or information.

7.3.1.1 The Standard Learning Station

Participants all had a networked PC of the same specifications as those used in the pilot study (with a 1.86 GHz Intel Core Duo processor, 2 GB RAM , and on board audio and video cards) connected to the Computer Science and Information Systems departments' LAN. All standard learning stations ran Windows XP as their operating system, and participants could once again select either Mozilla Firefox (version 2) or Microsoft Internet Explorer (version 7) as their web browser. They were provided with the same Logitech Premium Stereo USB headsets (each incorporating a microphone), and Logitech QuickCam Chat webcams, as were used in the pilot study (Figure 7.3). Standard learning stations were situated in discrete offices (as opposed to cubicles) and were designed to be occupied by a single participant. The doors of these areas were closed to help ensure that participants had a quiet and uninterrupted space from which to take part in the class.

Figure 7.3 - A Participant at a Typical Learning Station (Photo Used with Permission)

7.3.1.2 Variations

Variations in hardware, software and environment were deliberately introduced to participant's learning stations to see how, if at all, these factors might impact on their experience of the class. Each participant had no more than a single variation in the composition and set-up of their learning station. The introduction of variations was intended to give some indication of the relative value to participants of the various elements of the set-up so as to give some indication of the best conditions under which to use the LVC in order to facilitate the interactive, collaborative and engaging learning that was desired. It would thus be necessary to examine participants' feedback particularly carefully after the class in order to ensure that any issues arising directly as the result of intentional variations did not affect the determination of whether the custom LVC software avoided the problems experienced with video-conferencing (Chapter 2).

Variations in hardware involved not providing one participant with a webcam, and not providing another with a microphone, thus limiting the ways in which they could participate in the class. All participants retained headsets so that they could hear the audio, however. Two participants used their personal PCs (also running Windows XP, and of identical specifications to those used in the test as these specifications matched the standard post-graduate machine) and took part in the test class from their cubicles in the post-graduate laboratory. Although this was not a limitation in itself, this laboratory was simultaneously in use by a number of other students who provided a source of background noise, background movement and distraction. Another two participants shared a single station in an office, so as to provide data on the experience of the use of the LVC when physical resources are limited. Participants who were not taking part using their own PCs were randomly allocated to stations.

7.3.1.3 Questionnaire

A questionnaire (Appendix E) was designed to assess participant reactions to the LVC test class, and was distributed to all participants directly after the class. It was organised into five categories, namely 1) Profile, 2) Opinions and Attitudes on the Facilitation of Synchronous E-learning Classes in the LVC, 3) Participant's Opinions and Attitudes about the LVC class, 4) Technical Issues, and 5) General Impression

and Comments. These categories and the questions they contained were similar to those used in the video-conferencing questionnaire, differing only as necessitated by the subject under investigation.

In terms of the structure of the questionnaire, one of the profile questions required respondents to indicate their age, another question required them to tick a box indicating their gender, and six questions allowed participants to respond freely to elaborate on previous answers or raise issues they felt were important. All other questions were structured as Likert item statements (as were the majority of the video-conferencing questionnaire questions), requiring participants to rank their degree of agreement or disagreement by circling a number on a four-point Likert scale (Trochim, 2006) ranging from strong disagreement on the left to strong agreement on the right. The scale once again had an even number of options to prevent participants from choosing the middle option, forcing them not to remain neutral on any of the Likert items (Uebersax, 2006).

Questionnaire results are available in Appendix F.

7.3.1.4 Demographics

All of the participants chosen for the evaluation class were post-graduate students in the fields of Computer Science or Information Systems. Of the eleven test class participants, eight were Information Systems honours (fourth year) students who had completed a course module on e-learning. The other three participants were an Information Systems PhD student, a Computer Science PhD student and a Computer Science Masters student. The oldest participant was 37 years of age and the youngest was 21, with a mean age of 25 years. Racially (employing the categories used in the 2001 population census by the Policy Co-ordination and Advisory Services of the South African Government (2006)) seven of the participants were “White”, three were “Black African” and one was “Indian/Asian”. All participants were middle class (none came from an economically disadvantaged background) and only two of the eleven participants were female. More diversity in terms of economic background and gender was precluded by the availability of participants meeting the sample requirements explained below.

The participant sample was chosen to be capable of using the given equipment and the LVC application with little to no training. All had indicated some interest in e-learning and knowledge management, making the topic of the evaluation class ("A Theoretical Investigation of the Synergy between Enterprise E-Learning and Knowledge Management") of interest to them. Finding the class topic relevant would hopefully encourage them to participate actively in discussions and in activities held during the class. Their experience with and interest in e-learning would also hopefully aid them in giving informed and relevant feedback to the questionnaire, drawing on both their perspectives as experienced learners in their fields, and their knowledge of e-learning and systems design.

7.3.1.5 Limitations

Female and economically disadvantaged participants were underrepresented in the sample group. Although the group included participants who would have been disadvantaged in terms of their race under South Africa's previous policy of Apartheid, these participants had been raised under conditions of relative privilege, some in other Southern African Development Community (SADC) countries, and had benefited from a middle-class upbringing. The group of eleven participants accurately reflected the typical class size envisioned for the use of the LVC, but only one test class was held. Responses were thus limited to the sample size of this single evaluation class, limiting the quantity of response data and meaning that the effects of novelty can not be ruled out.

7.4 Questionnaire Results and Discussion

The questionnaire was circulated to eleven participants, with a total return rate of 91% (ten out of eleven participants). Feedback from the facilitator was gathered by means of face-to-face discussion and email correspondence after the class.

7.4.1 Experience

Although a large number (72%) of participants had completed an honours module theory course on the subject of e-learning (delivered face-to-face in traditional classroom style), only 30% rated themselves as having had extensive training in how to participate in a synchronous e-learning course. Despite this, half of the participants ranked themselves as very experienced in participating in such courses. These rankings suggest that they had obtained this experience outside of the e-learning course module they had attended at Rhodes University.

7.4.2 Interactivity and Engagement

In the course of the test class, it became apparent that one particular student intended to act in a purposefully disruptive and attention-seeking manner. They interrupted the facilitator over the audio on more than one occasion and tried to interject tenuously related jokes into the audio discussion. They also posted unrelated comments to the text chat, described themself as the "class clown", logged off and back on to ask if other participants had missed them, and asked irrelevant and facetious questions. The facilitator commented that the facility to clear the text chat component was appreciated, under the circumstances.

The text chat log shows that at least two participants became very angry with the self-appointed "class clown". These participants, who were sharing a workstation, strongly reprimanded the troublemaking participant over the text chat, indicating that anyone exhibiting such behaviour was not wanted and was a hindrance to the class. Thereafter this participant toned down their behaviour and began to participate more seriously in the class, eventually contributing some interesting and insightful comments by both audio and text chat. This is a wonderful example of the group developmental theory principle of organic developmental flow (Schulz, 1998 & Gibb, 1964, in Lobel, Neubauer & Swedburg, 2002). The principle states that the development of group norms online will proceed as it would face-to-face, given an effective facilitator and a real-time, dynamic, and user-friendly environment, allowing for interactive and collaborative learning. Norms (informal rules adopted by groups to regulate behaviour within the group and within a specific context) play a pivotal role in a group's sense of community and level of productivity (Feldman, 1984: 47). They are established,

re-established or enforced to facilitate group growth or survival, clarify acceptable behaviours and help to prevent interpersonal conflict (Feldman, 1984: 48-49). When the active enforcers of a particular norm are the participants themselves who make up a group, these participants are usually taking the opportunity to express or reinforce their central values and those of the group (Hackman, 1976, in Feldman, 1984: 48), which in this case was the LVC class.

Considering the behaviour of the disruptive participant, the fact that 60% of participants disagreed that the LVC software helped to engage everyone in such a way that disengagement from the class and destructive behaviours were avoided was hardly surprising. Nor was it surprising that the same percentage of the class said the environment had been a distracter, given that it had contained so much activity that was actively intended to distract. It is interesting, however, that 40% of participants did not believe that environmental distraction or disengagement were a problem. These students either felt very engaged and interested in the class and were not bothered by the disruptive participant, or felt the way the situation was resolved (the participant being criticised by their peers and thereafter ceasing the behaviour) was effective in re-establishing or clarifying group norms and values, as previously discussed. The fact that the actions that lead to the resolution of the problem were taken by participants could have created a sense of empowerment amongst the class as a whole, and helped to promote a feeling of mutual responsibility for learning that is so important to a collaborative online class (Palloff & Pratt, 2001b: 1 – 5).

All participants agreed that the class had been interactive; 80% of participants felt this strongly, and 70% ascribed their feelings to the impact of the LVC. The facilitator commented that communication with and amongst participants occurred fully and easily, and that participants achieved the distinct online presences considered so important in computer mediated distance educational environments (Tu, 2000). The ability to address individual students as well as the class collectively, elicit individual feedback via video, audio and text messaging, and then respond to this feedback as well, was considered essential in accomplishing the sort of interactivity usually associated with a face-to-face classroom.

Only 20% of participants reported feeling distanced from the facilitator and other participants, and feeling disengaged from the class. Interestingly, these participants were those who were taking part from the public post-graduate laboratory. They were surrounded, for the duration of the LVC class, by students going about their usual business and talking in the background. Similar environments in business and industry (such as cubicles in open-plan office spaces) are recognised as a source of distraction to synchronous online class participants (Hofmann, 2004: 56) and sometimes result in feelings of disengagement and distance, so it is likely that the same principle applied here. Two participants ascribed their positive feelings of engagement and lack of distance to the impact of the LVC technology itself. Both of these students were Computer Science rather than Information Systems majors, and so could have been more comfortable in online environments and digitally facilitated social groups due to increased familiarity with these. It follows logically that the less familiar and less confident a participant is in a particular environment, the more likely they are to feel distanced and disengaged from a group of more confident peers. Participants (for future courses) who act diffidently in online environments would thus benefit from time spent in the LVC, for the purpose of familiarisation and training in the use of the application.

Four participants (40%) did not feel involved in the class. Of these, one participant was stationed in the post-graduate laboratory (and had also reported feeling distracted), one was sharing a workstation and had found the text chat very distracting (section 7.4.3 of this chapter), and one had no webcam. This last participant commented in the free response section “if no webcam felt distance” [*sic*], so the absence of a camera was clearly an important factor in their experience of the class. Interestingly, none of the participants used the participant camera in the LVC for very long periods of time during the class, appearing only when asking a question or raising a point. Some participants only used this facility once, and for a few seconds, but despite this, not having the option do so if so desired was enough to make the participant without a camera feel marginalised and thus distanced. The participant without a microphone coped somewhat better despite the fact that the audio was used much more than the video. They admitted to being shy at the end of the class (over the text chat), however, so for them the lack of a microphone might have functioned as a

convenient way to indulge this shyness and protect the participant in question from being expected to contribute to discussion over the audio.

7.4.3 Learning Pace

Possibly due to the distraction factors already mentioned, 60% of participants felt that they couldn't easily concentrate on the class, and 20% indicated that the LVC itself had been a factor in their experiencing this problem (although 10% felt that the LVC was a factor in why they did not experience this problem). Other possible distractions are the novelty of the technology, or some factor implicit in the design of the interface. One of the participants, who objected to the disruptive participant and their behaviour on the text chat, commented that the text chat had been distracting and had caused difficulty in concentrating and engaging. They suggested changing the interface to allow the text chat to be turned off during the class, and another participant suggested moderation of the text chat for the same reason.

Hofmann (2004: 56-57) reports a similar comment from a participant in one of the synchronous online facilitator's training workshops she frequently runs. She cautions new facilitators against disabling chat functionality, saying that doing so would remove an outlet for disengaged participants to express themselves, and could leave the facilitator unaware of these participants' lack of engagement. Closing off one avenue of inappropriate or disengaged student behaviour is no guarantee that the problem will be solved either, as the participant responsible could simply reroute their behaviour into a different communication channel, for example, by interrupting over the audio instead of the text chat. Hofmann suggests that facilitators use a moderator to interact directly and specifically with distracting and disengaged participants over the text chat, in order to find ways to include them.

Some enterprise solutions like Adobe Breeze allow certain modules like text chat to be disabled during synchronous online classes, or access to the modules to be restricted to only the facilitator. The LVC developed here for the Universities' use intentionally did not include this functionality (as per the discussion on the suitability of various commercially available LVC's features to the Universities' needs in Chapter 5). This was due particularly to the pedagogical principle (discussed in

section 5.2.11 of Chapter 5) of making the learning environment open and collaborative rather than authoritarian and instructor-centred. It could be argued that allowing the text chat problem to play out, instead of using a technical solution to stop it, solved the problem in a manner that upheld this principle. It avoided requiring the facilitator to act in an authoritarian manner, and helped to establish social norms (section 7.4.2 of this chapter) for behaviour amongst participants that were determined by the participants rather than by the facilitator. This was particularly valuable as literature indicates that such norms reflect the values of the participants themselves and have a powerful impact on a group's behaviour and cohesiveness (Feldman, 1984: 47 – 52). They are more likely to be authentic and valid, and more likely to be consistently upheld by participants, than externally imposed or enforced norms.

Despite the above, if ongoing use of the LVC indicated that establishing an effective set of class norms (preventing features such as the text chat from being misused) proved consistently difficult, the functionality to disable the feature could be easily incorporated into the application. The possibility must also be considered that the text chat could be used in an entirely positive manner (with input that completely related to and supported a class topic), and still prove distracting to some participants. In this case it might benefit the distracted participants to spend more time in the LVC and attempt to acclimatise themselves to the sort of digital multi-tasking common in such online environments, before the facilitator resorted to disabling the feature.

Sixty percent of participants agreed that all participants maintained the same pace of learning, and only 10% strongly disagreed with this. The same number of participants (60%) reported feeling in control of their own learning process, and 30% felt that the LVC had impacted positively on this, although one participant felt that the LVC had detracted from their feelings of control over their own learning. It may be relevant that, of the four participants who did not feel in control of their learning, one was the participant sharing a station and another was the participant without a microphone.

7.4.4 Anonymity and Inequitable Learning Experiences

Sixty percent of participants indicated that they felt that variations in participants' individual learning contexts and or backgrounds would in fact be highlighted by the

LVC technology. Half of the participants believed that the LVC made some participants inequitably anonymous in comparison to others. Of the five participants who felt this way, one was the participant who was sharing a station, and another was the participant who had no webcam (the same participant who reported feeling left out of the class in section 7.4.2 of this chapter). The participant without a microphone disagreed, perhaps indicating once again that they had felt comfortable or protected by this. It is possible that the existence of the participant with no microphone and the participant with no camera could be the reason for the perception that some participants were inequitably anonymous. The participant with no microphone was occasionally addressed by both the facilitator and the other participants, and had to remind them that answers could only be forthcoming via the text chat. Similar incidents occurred with the participant who had no camera, in which they were asked to broadcast video and had to explain that they could not, evoking reactions ranging from sympathy to gentle teasing from peers. Unfortunately none of the respondents explained their Likert item rankings or said anything further about them in the free response comments section. It is thus difficult to tell if they felt that the LVC highlighted variations in learning contexts and made some participants inequitably anonymous in a general manner, or whether this was a direct result of the intentional variations in resources allocated to participants (section 7.3.1.2 of this chapter). Generally these variations in resources were not popular and indicate that although it is possible for participants with more limited hardware resources to take part in an LVC class, this can cause both confusion and frustration on occasion for them and their peers.

7.4.5 Relationship between Facilitator and Participants

Every participant felt that the facilitator connected positively with the class, and agreed that the facilitator felt enthusiastic about the opportunity to facilitate a class using the LVC technology. Participants also all agreed that the facilitator was able to devote sufficient attention to all participants. This was a particularly pleasing result as it was one of the major problems with the previous video-conferencing system, but it must be acknowledged that different results could be forthcoming with a different facilitator, given the powerful influence of facilitators' pedagogical styles and strategies on an LVC class (Kunz, 2000: 1646, Howard, 2006: 10). Despite this, the

test indicates that, given a competent facilitator, the LVC does make it possible for the sort of positive and interactive relationship desired between facilitators and participants to be engendered within it. The facilitator in question had facilitated classes over video-conferencing in the past and had found it more difficult there to establish the sort of positive connections they succeeded in establishing in the LVC, and more difficult to devote sufficient attention to each participant. The facilitator was generally very positively received by the class, and thus any negative responses to the LVC environment can be safely assumed not to be in any way related to poor facilitation.

Almost all (90%) of participants agreed that the use of a second facilitator or moderator (a role acknowledged to be particularly valuable in a synchronous online class (section 4.6 of Chapter 4)) could be beneficial or offer useful possibilities in the LVC environment. The one dissenting participant was the disruptive participant, begging the question of whether this participant rejected the idea of a second facilitator or moderator because such a person could make classes more controlled and create an environment in which it could be more difficult to act in a disruptive manner. The facilitator commented that managing a multitude of simultaneous tasks, like checking the hands-up list and the text messages while facilitating, was challenging. They felt that a moderator would have been of great value in assisting with monitoring these features, and taking on some of the facilitation tasks when appropriate. They noted further that this sort of monitoring is likely to increase in complexity if the class size increases.

7.4.6 Relationship between Participants

Participants generally seemed to relate well to one another during the LVC class, and were considered to have connected and interacted with one another in a positive manner by 90% of respondents. This could be due in part to many of the participants having met face-to-face before the class (section 7.4.7 of this chapter), and also due in part to the audio, video and text chat aspects of the class. Participants generally seemed to enjoy interacting over the audio, and one participant commented that “seeing [other] participants, especially when they are commenting” was a highlight of the LVC environment. Interaction between participants in the text chat helped to

establish class behavioural norms (e.g. when participants reprimanded a disruptive peer (section 7.4.2 of this chapter)), and included requests for help from the facilitator and other participants. Good natured banter and teasing between most participants contributed to a sense of community and fun during the class, and should have been effective in decreasing feelings of distance (Rovai, 2001: 34 -35).

Before the LVC class 90% of participants reported feeling enthusiastic about participating in the class using the LVC, and 60% reported feeling very enthusiastic. After the class all participants reported feeling pleased and positive about their experience of participating in a class using the LVC, and of these 70% rated themselves very enthusiastic about the experience. The broad perception of a positive relationship between participants could play a role in this enthusiasm, as could the perceived positive relationship between participants and the facilitator (section 7.4.5 of this chapter). These could arguably be a significant part of the reason that 90% of participants said they would like to take part in another class using the LVC, although the novelty value of the technology must also be considered as a potential reason for the high enthusiasm levels.

7.4.7 Pre-class Face-to-face Meetings

A large majority of participants (90%) felt that having previously met one another face-to-face contributed to a positive dynamic within the LVC environment during the class, in accordance with the majority of the literature (Johnson, 2001: 56). The participant who disagreed with this was one who had not met all of the other participants face-to-face beforehand. Eighty percent of participants felt that pre-class face-to-face meetings are beneficial to both facilitators and participants, the remaining 20% seeing them as most beneficial to facilitators.

7.4.8 Transmission Quality and Clarity

Audio and video transmission quality and clarity in the test class were ranked as “high” by most (80%) participants, and audio and video were considered by all to be well synchronised. The facilitator commented that their audio stream was of high quality, but that they had difficulty hearing one of the participants. The source of this

participant's audio problem was eventually discovered to be the fault of the participant, who was running an instant messaging application at the same time as the LVC (to talk to friends who were not taking part in the LVC class), contravening instructions to close other applications. The participant did not realise that the instant messaging application took over the audio input whenever it was made the active window.

The facilitator observed that although they used the video facility sparingly to broadcast themselves to the class, it worked well and proved to be more valuable than anticipated, particularly as it gave them the ability to "call up" a participant to activate their video at any time.

Half of the participants did not consider the digital learning materials (e.g. slides) used in the class to be clear and readable. The facilitator commented that this could be because the slide set included some scanned images that were at a less-than-optimal resolution, in which case better quality digital learning materials would solve the problem. One participant's comments offered a different take on the perceived problem; he noted that the LVC application did not make full use of his browser window and as such the slides appeared small. The problem is dealt with in Chapter 9, in the Adaptations section.

7.4.9 The Respective Importance of Transmission Elements

All participants agreed that the ability to see the facilitator, the learning materials (e.g. slides) and the participant using the participant camera (if and when appropriate) clearly, and all at the same time, was very valuable. A majority of 60% of participants indicated that they felt this strongly. All participants ranked the transmission of the facilitator (including voice and video when appropriate) as an important element of the LVC class, and 70% of them ranked this as very important. All participants ranked learning materials as an important element of the LVC class, and 40% ranked these as very important. Not all participants ranked the transmission of themselves and other participants (including voice and video when appropriate) as an important element of the LVC class, however; 40% felt that this was not important, and only 20% felt that it was very important. This indicates that the transmission of participants is still

viewed as less important than that of the facilitator and the learning materials, implying that participants are considered a secondary source of learning compared to the facilitator or the learning materials. In a truly collaborative and constructivist learning environment peers should be recognised as a valuable learning resource, and considered a vital part of the learning process (Trentin, 2002: 56-58). The test lecture, although as interactive as possible, included some very theoretical components in a topic on which the facilitator is recognised as an expert and on which they had recently presented a paper at an international conference. It could be argued that given the content of the class, this was simply a case where peers were not contributing to the learning process to the same extent as the other transmission elements identified (the facilitator and the learning materials). It thus it can not be concluded from the Likert item rankings whether those who considered the transmission of participants unimportant considered learning collaboratively from and with peers to be a rich and valid form of learning or not.

7.4.10 Perceptions of the LVC Environment

All participants indicated that it is important for facilitators to have practise in the use of an LVC environment, and the facilitator agreed, commenting that anyone facilitating a synchronous online class needs to be very comfortable with using the technology before taking a class of participants. Without this level of familiarity with the LVC, they noted, facilitators run the risk of both incurring technical problems and failing pedagogically to engage the class.

Although facilitation is perceived as a very skilled occupation, 60% of participants disagreed that LVC class participation requires particular skills for participants, and did not believe it was desirable for participants to have had practice in the use of LVC software and in the LVC environment before taking a class. This was probably due to the fact that most (80%) of the participants did not find the environment intimidating. The facilitator concurred, commenting that in their opinion the technological experience required by participants to take part in a class using the LVC application is minimal, and that inexperienced users could easily be given all necessary training ahead of time via a short meeting in the LVC.

Ninety percent of participants indicated that they felt comfortable operating in the LVC environment, and all participants indicated that they quickly felt confident therein. The indication that practise was considered necessary for facilitators could, as such, have been a recognition of the difficulty involved in keeping a class interactive, ensuring that sufficient attention is paid to all participants, keeping track of the text chat while also talking over the audio, and so on. E-facilitation is a recognised to be a particular skill, and this is reflected in the literature (section 4.5 of Chapter 4).

7.4.11 Perceptions of the LVC Technology

All participants rated the LVC technology as straightforward to use, and 70% thought that the technology had made it easy for all participants to take part in the class without difficulty. The facilitator observed that the process of accessing and entering the classroom was easy, and that participants found setting their connection type for the session to be so simple as to be obvious. The facilitator found both advancing the slides and using the whiteboard to be simple, and noted that using these tools did not detract their attention from other facilitation activities at hand. They commented that encouraging participants to use the slide browsing and synchronisation buttons had the positive effect of giving them a sense of control over what they were viewing, as well as promoting a feeling that the class were working together as a group.

Almost all participants (90%) indicated that they felt that the LVC technology supports interactive and engaging synchronous e-learning over the web. An equivalent percentage agreed that features of the technology facilitate and support different styles of learning such as aural/visual/verbal styles (their responses being based on the seven commonly identified learning styles explained to them in an appendix to the questionnaire). One participant elaborated in the free response section, indicating as a positive point about the LVC that “the use of multiple mediums for teaching, as well as multiple channels of conversation, allows for various means of communication, especially when a learner is not comfortable with one particular medium”.

Sixty percent of participants agreed that the video transmission feature allowed them to make eye contact with and read the facial expressions of the other participants/the facilitator (if and when appropriate) over the LVC link. These were identified by

participants as important because they help them engage with and feel connected to the rest of the class in a similar manner to a face-to-face class, findings in accordance with the literature (Horton, 2000: 259; Bean, 2005: 2). Facial expressions were reported to make the experience feel more personal, communicating interest and enthusiasm and, in the words of a participant, "help[ing] comprehension and emphasis in a big way". Making eye contact by looking directly into the camera was felt to indicate interest and attention to the facilitator and other participants.

The camera tool was not considered by most participants (70%) to allow the reading of body language, as the webcams were generally focussed on the facilitator's and participants' heads and did not show their entire bodies. Despite this 30% of participants felt that body language was successfully conveyed, presumably by the movement and posture that could be seen in the relatively closely-focussed camera shots, and one participant commented that body language helped to keep them "focussed on the topic and the facilitator".

Half of the participants felt that the LVC system was unreliable during the class. A participant who repeatedly lost the ability to transmit audio (discussed in section 7.4.8 of this chapter) may account for this impression. The cause of the problem was unrelated to either the hardware or the LVC, but this was not revealed to the class, meaning that the problem may have affected their perception of the reliability of the LVC application. No other major problems occurred during the class, so if this was not the case, the source of this perception is unclear; none of the participants who felt the system was unreliable explained further in the free response section.

7.4.12 Overall Impressions

In the text chat at the end of the class, participants described the LVC class experience as "awesome", "amazing", and "a great environment", and in the free response section the LVC application was described as having "good audio and video aspects" and being "effective". The facilitator reported greatly enjoying using the LVC and finding the system to be a much more powerful learning environment than they had anticipated. They commented that the features were simple but contributed to creating a rich and interactive teaching and learning experience.

All participants said that they would recommend the LVC to others. Ninety percent of participants indicated that they would recommend it for specific teaching styles or learning situations, and suggestions included “distance learning”, “anything that keeps the students involved”, and “discussion groups/brainstorming sessions”. One participant clearly felt that the environment supported collaborative learning, despite the fact that this design principle had never been made public to the participants; he recommended the LVC for “situations where one wants to avoid the traditional trend of having one person who imparts all the knowledge”.

The participant without a microphone cautioned against the use of a set-up of this nature for learners with certain learning difficulties such as dyslexia, as dyslexic participants could struggle if dependent on the text chat to express themselves. Another participant, who had used a station with both a microphone and a camera, suggested that all participants using the LVC environment should be thus equipped, clearly feeling that participants missing either of these elements were at a disadvantage. They intimated that background noise had been a problem for some participants (definitely the case for those participants taking part from the post-graduate laboratory), and needed, ideally, to be eliminated.

Participants also made recommendations for the sort of subject matter they felt would be best taught in the LVC environment. One participant felt that it was most suited to “easily quantifiable concepts, as there is a lack of [the] empathy that is required in order to explain various ‘touchy-feely’ concepts”. This is counter to a large proportion of practice in industry (noted during the LVC survey in Chapter 5) where LVCs are frequently used for soft skills training programmes aimed at business people. Another participant suggested the use of the LVC for the teaching of “non-practical subjects”, due to the difficulty of including a practical component. Although it would be ideal to teach such subjects in an environment where they can be simultaneously demonstrated, many practical subjects (such as chemistry and biology) are routinely taught in lecture rooms without a practical component, this being addressed in practical laboratory sessions at a different time. The problem with using this model for the LVC is that, as participants are geographically distributed, it could be problematic or even impossible for them to get together with the rest of the LVC class

for laboratory sessions. They could arguably complete these alone but for their learning to remain both synchronous and collaborative they would have to communicate with one another about the process in some way in real time. For these sorts of classes/courses it is possible that blended instruction (Mantyla, 2001: 3; Thorne, 2003: 5-18), i.e. a blend of different learning technologies and methods (probably including synchronous and asynchronous elements), would be a better solution than an entirely synchronous class/course.

With respect to other comments in the free response section of the questionnaire, one participant suggested that the LVC only be used once all participants have met face-to-face, but did not elaborate as to why. The test class was criticised by a participant as being too long, making it difficult to maintain concentration, and a lesson length of no more than 40 minutes without a break was suggested.

The LVC application itself was criticised by another participant for its design aspects in the "use of buttons…[and] colours", but none of the other participants mentioned this as a problem, so it is possible that this participant's issues with the user interface were merely a matter of personal preference. The text chat component allowed users to set their text colour and this was initially used to personalise their input (although all input was also associated with the login name of the participant who had typed it). The facilitator suggested using the colour options to code messages to the group relating to different issues and at different priorities, a novel approach that could prove very effective.

A participant emailed a late comment after handing in the questionnaire, saying:

> *Whilst listening to the others talk, I was able to surf the web and find very important information that could make a really positive contribution to the discussion. One could not do this in a normal [face-to-face] classroom setup. I could still listen to the discussion and watch everyone whilst searching the web, which was really cool. Often I would remember something that I read in the past and felt that I should let the other participants know as well, but in some cases in a classroom I would not remember everything that I wanted to*

> *say. By searching the web quickly, my comments were clear and accurate – which was really cool I thought.*

This was a pleasing observation as it showed the participant had used their initiative to take advantage of some of the options available to users of synchronous e-learning applications like the LVC, and this had happened naturally and with no specific training. The participant had in fact stumbled onto a technique also used to supplement and add value to face-to-face classes know as "Google Jockeying" (Educause Connect, 2006). In this technique a member of a face-to-face class (different for each class, allowing many students to take a turn) is given the role of Google Jockey for the class, and tasked with augmenting and clarifying the class topic by surfing the Internet – whilst the lecture is taking place – for related sources of information (including pictures, terms, and relevant resources). The Google Jockey's progress is shown live on a screen. The extension of such practices into face-to-face classes serves to underscore the extent to which the use of applications like the LVC can in fact add value to learning experiences above and beyond what is available in a traditional face-to-face classroom, and, in doing so, can help to create more empowered and more effective collaborative learners. With the vast resources available on the Internet participants can all contribute to a discussion both accurately and to a greater extent than they would be able to alone. This makes the Internet a type of scaffolding for collaborative learning, and extends Vygotsky's "zone of proximal development" (Tu, 2000; Kearsley, 2006) idea into a digital environment.

A few modifications were suggested to the LVC application, such as changing the LVC to allow the facilitator to bring up any participant's webcam at will. This could be useful to a facilitator, particularly with less technically astute classes, but would change the balance of power in the classroom back towards privileging the facilitator and elevating them above the participants. This reinforces the idea of the facilitator as an authoritarian figure who dispenses knowledge, and lends itself to a more instructor-centred and less learner-centred style of teaching and learning, which is contrary to the principles envisioned for the use of the LVC when it was designed.

Similar considerations apply to the participant's user names. During the class, the aforementioned disruptive participant changed their user name a number of times as a

joke, annoying others. A participant suggested in conversation after the class that participants be banned from changing their user names during a class to prevent such behaviour. This would be a technical and authoritarian solution to a sociological problem that should be addressed through the establishment of suitable class norms (discussed in section 7.4.2 of this chapter). Preventing name changes would take the responsibility for acceptable behaviour away from the individual participants, which would not contribute to the sort of active collaboration envisioned; it would prevent a problematic attitude being expressed in action via a particular channel of communication, but not change the problematic attitude. It would also prevent participants from being able to take advantage of the ability to change their names to indicate important information without interrupting the class (e.g. from "John" to "John – Away from keyboard" or "John – Minor emergency, be back soon"), a common convention in group chat programs like IRC (Internet Relay Chat) and in other Internet chat-rooms.

Lastly, a participant identified a problem with the attendee list in the classroom. The list is arranged alphabetically, and as such, when the list of participants is longer than the size of the attendee list box, participants at the end who raise their hands are not noticed by the facilitator. The facilitator concurred that this was a problem, and also commented that although the attendee list was useful for noting absent participants and dropped connections, these were overlooked if they related to participants at the end of the list. This problem is addressed in the Adaptations section of Chapter 9.

7.5 Conclusion

Based on the data (gathered from the questionnaires and email feedback, from direct observation of the test class, and from conversation with the facilitator and the participants thereafter), both the facilitator's and the participants' reactions to the LVC and the test class were generally quite positive, indicating enthusiasm and enjoyment. Although further testing would be necessary to determine to what extent their reactions were affected by the novelty of their experience, such an initial reaction is encouraging.

Chapter 8 – General Discussion and Conclusion

8.1 Introduction

It remains to consider whether or not the custom LVC application provides a suitable alternative to the existing video-conferencing solution that could improve the facilitation of distance learning between the Computer Science departments of Rhodes University and the University of Fort Hare. In order to determine this, it is necessary to assess how well the custom LVC met its design goals to provide a simple, flexible and customisable application to support a strongly interactive, learner-centred teaching and learning environment for small academic group use. It is also necessary to appraise the extent to which the custom LVC helped to prevent the problems identified with the use of video-conferencing (summarised in section 2.4), and the impact of any new problems not experienced with video-conferencing that were found to be associated with the use of the custom LVC.

8.2 General Discussion

Technical problems had been experienced with video-conferencing in terms of the synchronisation of voice and video, and the ease of transmission and clarity of learning materials. The LVC was rated more highly than video-conferencing in terms of the synchronisation of voice and video, but did not show much improvement in terms of clarity and readability. Potential reasons for this were identified, however, and steps to be taken to improve the situation are outlined in section 9.2 of Chapter 9. The LVC thus has the advantage over video-conferencing of being flexible and customisable (meeting one of its design goals) so that problems can be addressed in software as well as in terms of facilitators' approaches and choices of learning materials.

The LVC also proved to be satisfactorily reliable from a technical perspective, and no problems occurred that could be ascribed to with the operation of the application itself.

Participants felt confident and comfortable in the LVC environment, and did not feel it to be intimidating or particularly complex, as they did not feel that they needed training in its use. This indicated that the LVC met its design goal of providing a simple solution.

The investigation into problems experienced with the use of video-conferencing revealed that the technology impacted negatively on the establishment of relationships within the classes, to a certain extent between the facilitator and the participants, but particularly between participants. With the use of the custom LVC, relationships in the evaluation class between the facilitator and the participants, and between the participants themselves, were generally very positive, a definite improvement on those in the video-conferencing environment. A certain amount of antisocial and attention-seeking behaviour did, however, occur in the LVC. This was not prevented by the application (although, had the facilitator granted full privileges to all participants, it could have been worse; as it was the disruptive participant did not have access to the master slide controls or whiteboard controls at all times). The multiple channels of communication provided in the LVC meant that antisocial behaviour could occur in multiple ways, but also provided multiple channels by which to address the problem if necessary. Possibly more importantly, this helped to prevent the problem of participant disengagement occurring in such a way that the facilitator did not even notice.

Inequalities were reported between the two participant groups using the video-conferencing system; the remote group was prejudiced, outpaced by the co-located group, comparatively anonymous, marginalised, and frequently disengaged from the class. The LVC improved on this situation immediately by placing all participants on the same footing, so there was no remote “group”, as all participants and the facilitator take part in the same way. As such all are aware what others are experiencing, and no particular participant or group of participants is treated differently. Inequitable learning experiences reported to have been experienced in the LVC evaluation class seemed all to be of a physical nature, related to the presence or lack thereof of equipment due to intentional variations.

Sharing participation stations was unpopular and the responses from the participant who did so were generally less positive than those from the other participants, suggesting that sharing stations is possibly best avoided in the future. It also seems prudent to avoid real teaching and learning situations where anyone participates without the necessary hardware to take advantage of all the LVC's functionality. It is possible that negative reactions from both the sharing participant and those lacking a hardware element (a webcam or microphone) were due to these participants perceiving themselves as different and thus feeling marginalised. It could thus be the case that if all participants in a class were in the same situation – all were sharing, or all had no webcam, *etc*. – these situations would not have been experienced as unpleasant or inequitable, but this is unclear without further investigation. Further testing to this end could be carried out by running two more evaluation classes, one in which all participants had all equipment and one in which all were lacking some element (e.g. missing a webcam or sharing stations).

It is unclear whether other differences that exist between participants' learning situations and backgrounds are highlighted by the LVC, compromising participants' learning experiences; it is possible that the sample group was of too homogenous a background to indicate this. No incontrovertible conclusions can be drawn about the impact of the LVC on learning pace either, as in order to do this the variable of distraction (caused by environmental disturbances and the misbehaving participant) would need to be eliminated. Further testing might help to clarify the issue, assuming that distractions unrelated to teaching and learning in the classes could be eliminated (e.g. by the establishment of disruption-free participation stations for all participants and the entrenchment of a set of class norms preventing disruptive behaviour).

It is also uncertain whether the problems some participants had focussing on the class could be ascribed simply to the presence of multiple channels for communication, or to the misuse of these channels. Would the participant who found the text chat distracting, for example, still have done so if it was used less or if the text that was typed in had been more focussed on the topic and abused less by the disruptive participant? Whatever the case, it seems clear that the assumption in designing a learning environment for learner-centred and collaborative teaching and learning (rather than instructor-centred and authoritative teaching and learning) is that learners

in fact want to learn, and are relatively proactive and responsible about doing so. Collaborative and constructivist teaching and learning can not exist in an environment in which learners are passive or uninvolved, actively resisting learning or actively attempting to prevent others from learning. Thus a balance is required in an LVC class between not participating at all and losing the advantages of multiple communication channels, and abusing these channels in a destructive and immature manner.

Disruptions detracted from the learning experience for many participants, and were not prevented by the design of the LVC application, which impacted on the degree to which the test class was experienced as engaging. Despite this, levels of interactivity and engagement in the LVC evaluation class were higher than those reported in video-conferencing classes, showing a great improvement over these. Whether or not all classes given in the LVC will be learner-centred, interactive, collaborative, or, for that matter constructivist, depends on the teaching and learning material and the pedagogical style and strategy of the facilitator. Nevertheless the tools provided were shown by the test class to support the intended pedagogical approach, and so the LVC appears to be suitable for the sort of interactive, engaging, and learner-centred small academic classes envisioned for its use. This gives it an advantage over video-conferencing which provides no such tools and offers no specific support for any particular pedagogical approach. Classes given in the LVC should be tailored in both style and content to the LVC environment to take advantage of the tools and channels of communication this offers, in concordance with the literature (section 4.5 of Chapter 4). Participants indicated that they felt the LVC catered to a range of learning styles, so a facilitator who knows their class well could also tailor teaching and learning activities to appeal to these different styles using the features of the LVC best suited to each.

On the whole the research produces a clearer understanding of how current pedagogical practice applies to e-learning over distance, and provides the potential to significantly improve the quality of distance learning for Rhodes University and the University of Fort Hare. Most academic institutions in South Africa potentially have the expertise to develop a similar LVC solution for tertiary e-learning use over distance, and the approach is cost-effective, bringing it within the financial reach of smaller institutions. Custom development is beneficial, even to those institutions with

expansive budgets, as it allows the developer to tailor the LVC they create to their specific pedagogical needs, or to any particular discipline or group of learners.

8.3 Conclusion

The LVC test class yielded results that suggest that the LVC tool is able to support interactive, engaging and collaborative learning that does not necessarily prejudice any particular participant or group of participants. Positive relationships were established, both between the facilitator and the participants and between the participants as a class, although this was simpler and more effective if participants had met face-to-face before working together in the LVC. A variety of communication channels made it easy for participants to express themselves, but also provided more creative avenues for disruptive participants to negatively affect the class. The available variety of communication channels, combined with learning tools like the whiteboard and slideshow component, offered support for different learning styles. Technical problems were minimal. Some flaws in the design of the LVC were identified and need to be addressed, but as the LVC application was developed in-house, having these changes (or any others deemed necessary at a later stage) made to the LVC's source code should be relatively simple and inexpensive to affect.

As such the LVC application appears to meet its goal of providing a technically sound alternative e-learning solution for small academic groups in shared tertiary education that supports highly interactive, learner-centred education. It also meets its goals of ensuring that no particular group of participants is prejudiced by virtue of the nature of the solution, and being flexible/customisable/extensible so as to allow modification when necessary. It seems likely that LVC meets its goal of providing an engaging teaching and learning environment, although the LVC application was not so engaging as to entirely prevent participant behavioural problems in the evaluation class. Technical solutions to the problem of classroom disruptions, caused by misbehaving participants, could be established as part of the LVC application itself if determined pedagogically appropriate.

On the whole the custom LVC tool appears to be a good alternative to video-conferencing as an e-learning tool to facilitate shared tertiary education over distance,

and offers a number of pedagogical and logistical advantages over video-conferencing. The LVC is pedagogically sound in a South African context and could be easily adapted to the specific needs of any tertiary educational institute in the country. Despite the research being specifically focussed on an alternative e-learning solution for distance education between the Universities, it is hoped that the results may be of interest to other tertiary educational institutions involved in or dependant on distance learning, particularly those previously disadvantaged institutions like the University of Fort Hare who are under-staffed and thus lack the expertise to offer certain courses.

Chapter 9 – Adaptations, Extensions and Future Research

9.1 Introduction

During the LVC evaluation a couple of issues with the LVC application arose. These were 1) the problem of the participants in the attendee list falling beyond the visible area of the component and thus not being noticed when they raised their hands, and 2) the problem of the readability of digital learning materials like slides that did not take full advantage of high resolution browsers. These problems and approaches to solving them are outlined in this chapter, as are some potential extensions to the application. Finally, the possibility of extending the application to take advantage of mobile technologies is also briefly considered.

9.2 Adapting the LVC in Accordance with Participant Feedback

The LVC evaluation indicated problems with the attendee list part of the `AudioConference` component. The list is arranged alphabetically, and as such, when the list of participants is longer than the size of the attendee list box, participants at the end of the list who raise their hands are not noticed by the facilitator. The facilitator concurred that this was a problem, and also commented that although the attendee list was useful for noting participants who indicated that they were away from their keyboard for one reason or another, these were overlooked if the participants' names were located at the end of the list. The option of adapting the attendee list box to grow to fit all participants' names was rejected because it could lead to a very unwieldy component if the LVC was ever to be used with a large class. However, if participants with raised hands and those whose names changed (this being useful to indicate their status when they step away briefly, as discussed in section 7.4.12 of Chapter 7) were promoted to the top of the list, this would effectively catch the facilitator's attention. The `AudioConference` component could thus benefit from the addition of code to detect participants with raised hands and changed names and reposition these at the top of the attendee list.

Another problem was identified in section 7.4.8 of Chapter 7 when a participant suggested a likely reason for the perceived lack of clarity of the slides in the LVC. This participant noted that their browser window was much larger than the application and that the slides thus appeared small and harder to read. The participant in question was using a browser on a machine with a large monitor, set to a high resolution, and his observations suggest that the LVC application could be improved by having it dynamically re-size its components based on a user's detected screen resolution. This would necessitate changes to the sizing of application as a whole, as well as to the `PresentationSWF` component which determines the size of the slides. The LVC application would need to detect screen resolution, or alternatively offer a user a way of inputting this or selecting it from a drop-down list, and then dynamically select the appropriately sized slideshow flash movies from an available prepared selection. As the `PresentationSWF` component overlays the `WhiteBoard` component and is matched in size to this, any changes made to the `PresentationSWF` component should also be made to the sizing of the `WhiteBoard` component.

9.3 Extending the Feature Set

Although the existing feature set is appropriate to the tasks required of it, certain extensions and additions could prove useful. The possibility of including more video windows has already been addressed (in section 5.2.9 of Chapter 5) along with its associated problems (limiting the number of potential users and requiring a great deal of bandwidth). Application sharing (section 5.2.10 of Chapter 5) also suffers from the drawback of being extremely bandwidth intensive, making it impractical in a South African context unless used exclusively within a LAN. Application sharing would however be valuable to a LVC in terms of promoting interactive and contextualised learning, and would be a valuable addition for use in high-bandwidth environments in the future.

The `WhiteBoard` would benefit from the capacity to load in a graphic, or to allow users to paste a graphic onto it, thus allowing annotation of that graphic without it being part of the slide set.

The capability to record classes that take place in the LVC could be useful if the content of these classes is ever intended to be shared with anyone other than the participating class, or simply for archiving purposes as it would make them available to those unwilling or unable to be present at the original event as well as those who would like to use the recording as a reference. This could be achieved by modifying the LVC to allow the recording of classes as Flash movies. A Financial Mail report claiming that 7City Learning[7], a major financial services training company, has seen a "300 percent increase in the number of downloads of recorded lectures via podcast and webcast over the past six months [January to June 2006]" (Boone, 2006) is indicative of the rising popularity of such recordings.

During the development of the custom LVC application design decisions were made in accordance with the principle that the application needed to remain as simple as possible whilst offering the most pedagogically valuable features. This meant that on occasion a fun feature was left out for the sake of simplicity. One such feature was extending the customisation of the `AudioConference` component undertaken in the development to allow more than one icon to be displayed alongside a username. This would allow users to display a small avatar, or perhaps even select emoticons representing their mood at a given time, and could be achieved by simply adding more complex data to the list in the `addItem` function. This can be accomplished by passing in a two dimensional array or, more simply, an object literal, as in Listing 9.1.

```
audio_lb.addItem(username, {btnStatus: tempItmObj, usrIcon: happy"});
```

Listing 9.1 - Adding More Complex Data Structures to a Listbox Using an Object Literal

The syntax required to access the properties of the object literal from `FCAudioConferenceClass`'s `displayContent` method is quite simple, involving merely referring to `itmObj.data.btnStatus` or `itmObj.data.usrIcon` instead of just `itmObj.data`.

Changes would have to be made to `FSelectableItemClass`'s `layoutContent` method to make space for new icons, and, if emoticons were desired, a new icon

[7] http://7city.com/

movieclip with a different emoticon icon on each of the various frames would need to be constructed. The `displayContent` method of the `FCAudioConferenceItemClass` could then check the value of `itmObj.data.usrIcon` and make the movieclip go to and stop at the frame containing the icon corresponding to the user's mood.

9.4 Future Work

It would be convenient to be able to access the LVC from places other than networked PCs, using the sorts of mobile devices that learners commonly carry with them, such as PDAs and smart phones. This would involve adapting the custom LVC, changing it from a purely e-learning tool to a mobile e-learning, or m-learning, tool. Metcalf (2006) explains that m-learning facilitates connective, online access to learning resources in a mobile setting, enabling people to access these resources (which can include other people) from outside the confines of homes and offices. Changing the LVC to an m-learning application could be achieved by using Flash Lite, as Flash Lite players are available for a number of mobile devices[8]. The application would have to be played by a version of Flash Lite player that supported the version of ActionScript used, but as FMS 2 currently requires the use of ActionScript 1 (the baseline for all versions of Flash Lite player) this is unlikely to cause a problem. However, changing the LVC to an m-learning application effectively would also necessitate some important changes in the design of the original LVC; the application would need to be simplified to include only essential features conducive to clarity and readability on the small screens of mobile devices, and usability over their restricted user interfaces.

9.5 Conclusion

The adaptations and extensions described in this chapter are not comprehensive. Users of the custom LVC application could easily take advantage of its flexibility and customisability to make other small changes, or use parts off the application as the basis for the creation of something even simpler, or more complex, depending on their needs. In this way the application could be customised for particular devices (as was

[8] http://www.adobe.com/mobile/

suggested in section 9.4 of this chapter), or for use within a particular context, discipline or institution.

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Glossary of Abbreviations

The following abbreviations are used in this document:

ABET	Adult Basic Education and Training
C2005	Curriculum 2005
CBT	Computer-Based Training
CD	Compact Disk
DVD	Digital Video Disk
FAQ	Frequently Asked Questions
FMS	Flash Media Server
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
ICT	Information and Communications Technologies
IDE	Integrated Development Environment
IRC	Internet Relay Chat
LAN	Local Area Network
LVC	Live Virtual Classroom
MCQ	Multiple Choice Question
NQF	National Qualifications Framework
OBE	Outcomes Based Education
PC	Personal Computer
PSTN	Public Switched Telephone Network
ROM	Read Only Memory
RSO	Remote Shared Object
RTMP	Real-Time Messaging Protocol
SAQA	South African Qualifications Authority
UI	User Interface
UML	Unified Markup Language
URL	Uniform Resource Locator
VoIP	Voice over Internet Protocol

Appendices

Appendix A Video-conferencing Facilitator's Questionnaire

Please answer the following questions with reference to your experiences facilitating classes in a video-conferencing environment. If you have facilitated more than one such class, please answer with respect to your average experience. Where reference is made to a co-located and remote group, the co-located group is understood to be whichever group is located at the same venue as you, and the remote group is understood to be whichever group is participating solely by the use of video-conferencing.

Profile

1. In which decade were you born?
   1980s or later
   1970s
   1960s
   1950s
   1940s

2. What was the duration of your video-conferencing course?
   1 to7 days
   8 to14 days
   15 to 21 days
   22 to 28 days
   >28 days

3. How frequently were classes held in your video-conferencing course?
   Daily
   A few times a week
   Once a week
   Once a fortnight or less frequently

4. The average number of students taking part in your video-conferencing course was:
   1 to 5
   6 to 10
   11 to 15
   15 to 20
   > 20

5. I am very experienced in synchronous e-learning facilitation.

Strongly Disagree	1	2	3	4	Strongly Agree

6. I have had extensive training in synchronous e-learning facilitation.

Strongly Disagree	1	2	3	4	Strongly Agree

Facilitator's opinions and attitudes about video-conferencing

The questions in this section are intended to determine **your** opinions about **your own**, **personal experiences**.

7. E-learning facilitation requires special skills.

Strongly Disagree	1	2	3	4	Strongly Agree

8. It is important for facilitators to have practice in the use of video-conferencing equipment and in the video-conferencing environment before taking a class.

Strongly Disagree	1	2	3	4	Strongly Agree

9. It is important for learners to have practice in the use of video-conferencing equipment and in the video-conferencing environment before taking a class.

Strongly Disagree	1	2	3	4	Strongly Agree

10. I found the video-conferencing environment intimidating.

Strongly Disagree	1	2	3	4	Strongly Agree

11. I found the video-conferencing environment to be a distractor within the educational environment.

Strongly Disagree	1	2	3	4	Strongly Agree

12. The use of another facilitator at the remote site is essential.

Strongly Disagree	1	2	3	4	Strongly Agree

13. Pre-course face-to-face meetings contribute to a positive dynamic within the video-conferencing class during the course.

Strongly Disagree	1	2	3	4	Strongly Agree

14. To whom do you think pre-course face-to-face meetings are most beneficial?
    The facilitator
    The co-located group of learners
    The remote group of learners
    Both groups of learners benefit equally
    No-one benefits

15. Variations in the contexts of learners in the remote group and the co-located group were highlighted by the video-conferencing technology.

Strongly Disagree	1	2	3	4	Strongly Agree

16. The video-conferencing technology allowed me to exercise complete control over the entire class.

Strongly Disagree	1	2	3	4	Strongly Agree

17. I felt I connected positively with the learners.

Strongly Disagree	1	2	3	4	Strongly Agree

18. The level of interactivity in the class was good.

Strongly Disagree	1	2	3	4	Strongly Agree

19. I was able to devote equal attention to both the co-located and the remote learners.

Strongly Disagree	1	2	3	4	Strongly Agree

20. As a facilitator I was not very aware of the remote group

Strongly Disagree	1	2	3	4	Strongly Agree

21. Before the video-conferencing course began I felt enthusiastic about the opportunity to facilitate a course using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

22. After the video-conferencing course ended I felt pleased and positive about the experience of facilitating a course using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

23. I would choose to facilitate another course using video-conferencing.

Strongly Disagree	1	2	3	4	Strongly Agree

Facilitator's impressions of the attitudes and responses of learners

The questions in this section are intended to determine **your impressions** of the **learners' experiences**.

24. The learners in the two different groups (co-located and remote) connected and interacted with one another in a positive manner.

Strongly Disagree	1	2	3	4	Strongly Agree

25. The co-located group felt disengaged from the remote group.

Strongly Disagree	1	2	3	4	Strongly Agree

26. The remote group felt disengaged from the co-located group.

Strongly Disagree	1	2	3	4	Strongly Agree

27. Learners in the remote group were relatively anonymous in comparison to the co-located group learners.

Strongly Disagree	1	2	3	4	Strongly Agree

28. The co-located and remote groups maintained the same pace of learning.

Strongly Disagree	1	2	3	4	Strongly Agree

29. To what extent do you agree with the following statements? Please tick the box to the right of each scale if you feel that video-conferencing technology had a significant impact on your rating.

a) Learners felt involved in the class

Video-conferencing a determinant? ☐

Strongly Disagree	1	2	3	4	Strongly Agree

b) Learners were able to concentrate easily on the class

Video-conferencing a determinant? ☐

Strongly Disagree	1	2	3	4	Strongly Agree

Video-conferencing a determinant?

c) Learners found the class interactive

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

d) Learners felt in control of their own learning process

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

e) Learners felt distanced from me as the facilitator

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

f) Learners were intimidated by the video-conferencing technolo

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

g) Learners felt distanced from their peers who were not in the same (remote or collocated) group.

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Technical issues

The questions in this section are intended to determine **your opinions** about **your own experiences** with technical aspects of video-conferencing.

30. I had total control over the camera

Strongly Disagree	1	2	3	4	Strongly Agree

31. Learning materials used in the course (e.g. slides) were clear and readable.

Strongly Disagree	1	2	3	4	Strongly Agree

32. The quality and clarity of the video was high.

Strongly Disagree	1	2	3	4	Strongly Agree

33. The quality and clarity of the audio was high.

Strongly Disagree	1	2	3	4	Strongly Agree

34. Audio and video were well synchronised.

Strongly Disagree	1	2	3	4	Strongly Agree

35. It was possible to see the facilitator, learning materials (e.g. slides) and the learners clearly, all at the same time.

Strongly Disagree	1	2	3	4	Strongly Agree

36. Which two of the aforementioned three elements of a video-conferencing class do you consider the most important for video transmission?
    The facilitator
    The learners
    Learning materials (e.g. slides)
    None of the above

37. The camera allowed me to make eye contact with the remote learners over the video-conferencing link.

Strongly Disagree	1	2	3	4	Strongly Agree

38. The camera allowed me to read the facial expressions of the learners over the video-conferencing link.

Strongly Disagree	1	2	3	4	Strongly Agree

39. The camera allowed me to read the body language of the learners over the video-conferencing link.

Strongly Disagree	1	2	3	4	Strongly Agree

40. The video-conferencing technology was straightforward to use.

Strongly Disagree	1	2	3	4	Strongly Agree

41. The elements of the system can be manipulated to customise the learning environment as necessitated by the needs of a particular class.

Strongly Disagree	1	2	3	4	Strongly Agree

42. The video-conferencing system can be easily amended and upgraded to incorporate new technologies or features.

Strongly Disagree	1	2	3	4	Strongly Agree

43. The video-conferencing system was completely reliable.

Strongly Disagree	1	2	3	4	Strongly Agree

44. Video-conferencing technology allows learners to participate in classes without difficulty.

Strongly Disagree	1	2	3	4	Strongly Agree

45. The video-conferencing system is adequate for my teaching needs.

Strongly Disagree	1	2	3	4	Strongly Agree

46. Video-conferencing is an effective learning solution.

Strongly Disagree	1	2	3	4	Strongly Agree

47. Is there anything else that you consider important about your experiences or observations that has not been addressed by this questionnaire? If so, please tell us about it here.

Appendix B Video-conferencing Participant's Questionnaire

Please answer the following questions with reference to your experiences as a participant in a video-conferencing class environment. If you have participated in more than one such class, please answer with respect to your average experience. Where reference is made to a co-located and remote group, the co-located group is understood to be whichever group was located at the same venue as the facilitator (i.e. teacher or lecturer), and the remote group is understood to be whichever group is participating solely by the use of video-conferencing.

Profile

1. In which decade were you born?
   1980s or later
   1970s
   1960s
   1950s
   1940s

2. What was the duration of your video-conferencing course?
   1 to7 days
   8 to14 days
   15 to 21 days
   22 to 28 days
   >28 days

3. How frequently were classes held in your video-conferencing course?
   Daily
   A few times a week
   Once a week
   Once a fortnight or less frequently

4. The average number of students taking part in your video-conferencing course (including yourself) was:
   1 to 5
   6 to 10
   11 to 15
   15 to 20
   > 20

5. I am very experienced in participating in synchronous e-learning classes.

Strongly Disagree	1	2	3	4	Strongly Agree

6. I have had extensive training in how to participate in synchronous e-learning classes.

Strongly Disagree	1	2	3	4	Strongly Agree

Learner's opinions and attitudes about the role of the facilitator in video-conferencing

The questions in this section are intended to determine **your opinions** on issues related to the **facilitation (i.e. teaching)** of video-conferencing classes.

7. E-learning facilitation requires special skills.

Strongly Disagree	1	2	3	4	Strongly Agree

8. It is important for facilitators to have had practice in the use of video-conferencing equipment and in the video-conferencing environment before taking a class.

Strongly Disagree	1	2	3	4	Strongly Agree

9. The video-conferencing technology allowed the facilitator to exercise complete control over the entire class.

Strongly Disagree	1	2	3	4	Strongly Agree

10. The facilitator connected positively with the learners.

Strongly Disagree	1	2	3	4	Strongly Agree

11. The facilitator thought the level of interactivity in the class was good.

Strongly Disagree	1	2	3	4	Strongly Agree

12. The facilitator was not very aware of the remote group

Strongly Disagree	1	2	3	4	Strongly Agree

13. The facilitator was able to devote equal attention to both the co-located and the remote learners.

Strongly Disagree	1	2	3	4	Strongly Agree

14. The use of another facilitator at the remote site is essential.

Strongly Disagree	1	2	3	4	Strongly Agree

15. The facilitator felt enthusiastic about the opportunity to facilitate a course using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

16. The facilitator found the video-conferencing environment intimidating.

Strongly Disagree	1	2	3	4	Strongly Agree

Learner's opinions and attitudes about video-conferencing

The questions in this section are intended to determine **your opinions** about your own, **personal experiences**.

17. I found the video-conferencing environment intimidating.

Strongly Disagree	1	2	3	4	Strongly Agree

18. I found the video-conferencing environment to be a distractor within the educational environment.

Strongly Disagree	1	2	3	4	Strongly Agree

19. Pre-course face-to-face meetings contribute to a positive dynamic within the video-conferencing class during the course.

Strongly Disagree	1	2	3	4	Strongly Agree

20. To whom do you think pre-course face-to-face meetings are most beneficial?
    The facilitator
    The co-located group of learners
    The remote group of learners
    Both groups of learners benefit equally
    Neither group of learners benefits

21. Variations in the contexts of learners in the remote group and the co-located group were highlighted by the video-conferencing technology.

Strongly Disagree	1	2	3	4	Strongly Agree

22. Before the video-conferencing course began I felt enthusiastic about the opportunity to participate in a course using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

23. After the video-conferencing course ended I felt pleased and positive about the experience of participating in a course using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

24. I would choose to take part in another course using video-conferencing.

Strongly Disagree	1	2	3	4	Strongly Agree

25. It is important for learners to have practice in the use of video-conferencing equipment and in the video-conferencing environment before taking a class.

Strongly Disagree	1	2	3	4	Strongly Agree

26. The learners in the two different groups (co-located and remote) connected and interacted with one another in a positive manner.

Strongly Disagree	1	2	3	4	Strongly Agree

27. Learners in the remote group were relatively anonymous in comparison to the co-located group learners.

Strongly Disagree	1	2	3	4	Strongly Agree

28. The co-located and remote groups maintained the same pace of learning.

Strongly Disagree	1	2	3	4	Strongly Agree

29. To what extent do you agree with the following statements? Please tick the box to the right of each scale if you feel that video-conferencing technology had a significant impact on your rating.

a) I felt involved in the class

Video-conferencing a determinant? ☐

Strongly Disagree	1	2	3	4	Strongly Agree

b) I was able to concentrate easily on the class

Video-conferencing a determinant? ☐

Strongly Disagree	1	2	3	4	Strongly Agree

Video-conferencing a determinant?

c) I found the class interactive

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

d) I felt in control of my own learning process

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

e) I felt distanced from the facilitator

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

f) I was intimidated by the video-conferencing technology

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Video-conferencing a determinant?

g) I felt distanced from my peers who were not in the same (remote or collocated) group.

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Technical issues

The questions in this section are intended to determine **your opinions** about and experiences with **technical aspects** of video-conferencing.

30. It was possible to have total control over the camera

Strongly Disagree	1	2	3	4	Strongly Agree

31. Learning materials used in the course (e.g. slides) were clear and readable.

Strongly Disagree	1	2	3	4	Strongly Agree

32. The quality and clarity of the video was high.

Strongly Disagree	1	2	3	4	Strongly Agree

33. The quality and clarity of the audio was high.

Strongly Disagree	1	2	3	4	Strongly Agree

34. Audio and video were well synchronised.

Strongly Disagree	1	2	3	4	Strongly Agree

35. It was possible to see the facilitator, learning materials (e.g. slides) and the learners clearly, all at the same time.

Strongly Disagree	1	2	3	4	Strongly Agree

36. Which two of the aforementioned three elements of a video-conferencing class do you consider the most important for video transmission?
    The facilitator
    The learners
    Learning materials (e.g. slides)
    None of the above

37. The camera allowed me to make eye contact with the other learners/the facilitator (if appropriate) over the video-conferencing link.

Strongly Disagree	1	2	3	4	Strongly Agree

38. The camera allowed me to read the facial expressions of other learners/the facilitator (if appropriate) over the video-conferencing link.

Strongly Disagree	1	2	3	4	Strongly Agree

39. The camera allowed me to read the body language of other learners/the facilitator (if appropriate) over the video-conferencing link.

Strongly Disagree	1	2	3	4	Strongly Agree

40. The video-conferencing technology was straightforward to use.

Strongly Disagree	1	2	3	4	Strongly Agree

41. The video-conferencing system was completely reliable.

Strongly Disagree	1	2	3	4	Strongly Agree

42. Video-conferencing technology allows all learners to participate in classes without difficulty.

Strongly Disagree	1	2	3	4	Strongly Agree

43. Video-conferencing is an effective learning solution.

Strongly Disagree	1	2	3	4	Strongly Agree

44. Is there anything else that you consider important about your experiences or observations that has not been addressed by this questionnaire? If so, please tell us about it here.

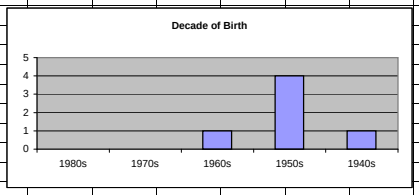
Appendix C - Video-conferencing Questionnaire Results

Video Conferencing Questionnaire Results - Facilitators

Profile

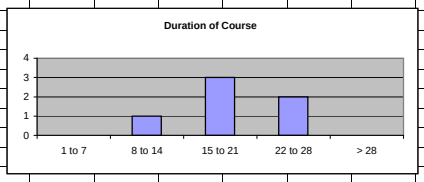
In which decade were you born?

	Decade	1980s	1970s	1960s	1950s	1940s
1	Facilitator 1				1	
	Facilitator 2					1
	Facilitator 3			1		
	Facilitator 4				1	
	Facilitator 5				1	
	Facilitator 6				1	
		0	0	1	4	1



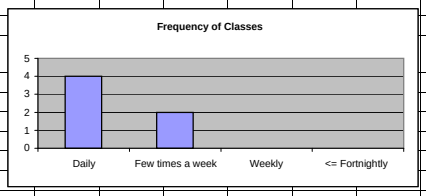
What was the duration of your video-conferencing course?

	Duration	1 to 7	8 to 14	15 to 21	22 to 28	> 28
2	Facilitator 1			1		
	Facilitator 2			1		
	Facilitator 3		1			
	Facilitator 4				1	
	Facilitator 5				1	
	Facilitator 6			1		
		0	1	3	2	0

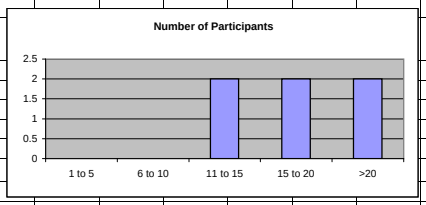


How frequently were classes held in your video-conferencing course?

	Frequency	Daily	Few times a week	Weekly	<= Fortnightly
3	Facilitator 1	1			
	Facilitator 2	1			
	Facilitator 3		1		
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6	1			
		4	2	0	0

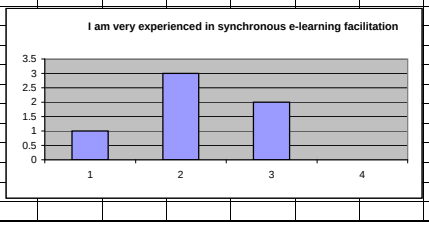


	Number of Participants	1 to 5	6 to 10	11 to 15	15 to 20	>20
4	Facilitator 1			1		
*	Facilitator 2				1	
	Facilitator 3				1	
	Facilitator 4			1		
	Facilitator 5					1
	Facilitator 6					1
		0	0	2	2	2



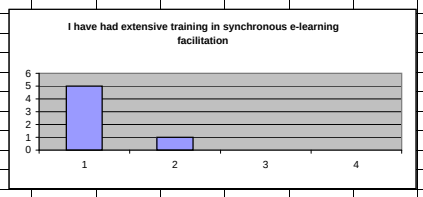
I am very experienced in synchronous e-learning facilitation

	Experience	1	2	3	4
5	Facilitator 1			1	
	Facilitator 2			1	
	Facilitator 3		1		
	Facilitator 4				1
	Facilitator 5				1
	Facilitator 6			1	
		1	3	2	0



I have had extensive training in synchronous e-learning facilitation.

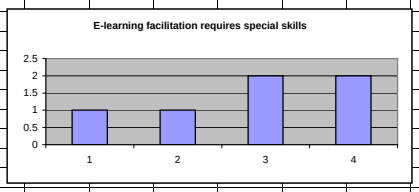
6	Training	1	2	3	4
	Facilitator 1	1			
	Facilitator 2	1			
	Facilitator 3	1			
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6	1			
		5	1	0	0



Facilitator's opinions and attitudes about video-conferencing

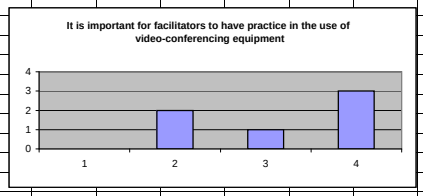
E-learning facilitation requires special skills

7	Skills	1	2	3	4
	Facilitator 1			1	
	Facilitator 2		1		
	Facilitator 3			1	
	Facilitator 4				1
	Facilitator 5				1
	Facilitator 6	1			
		1	1	2	2



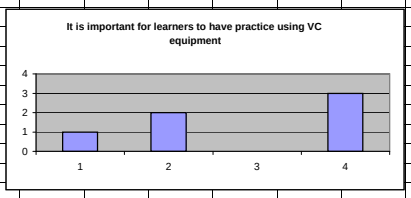
It is important for facilitators to have practice using VC equipment

8	Practice - F	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3				1
	Facilitator 4				1
	Facilitator 5			1	
	Facilitator 6		1		
		0	2	1	3



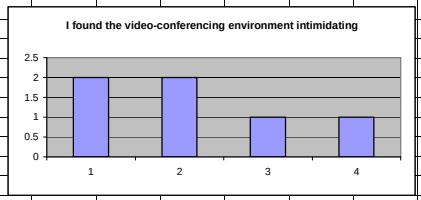
It is important for learners to have practice using VC equipment

9	Practice - L	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3				1
	Facilitator 4				1
	Facilitator 5	1			
	Facilitator 6		1		
		1	2	0	3



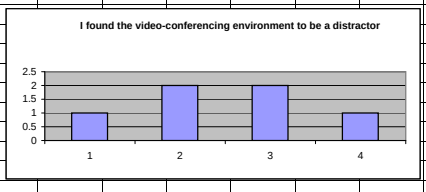
I found the video-conferencing environment intimidating

10	Intimidating	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3			1	
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6	1			
		2	2	1	1



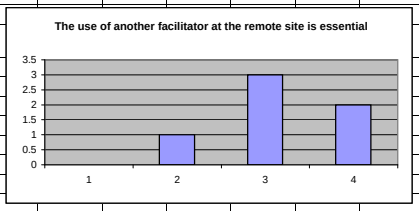
I found the video-conferencing environment to be a distractor

11	Distractor	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3			1	
	Facilitator 4		1		
	Facilitator 5			1	
	Facilitator 6	1			
		1	2	2	1



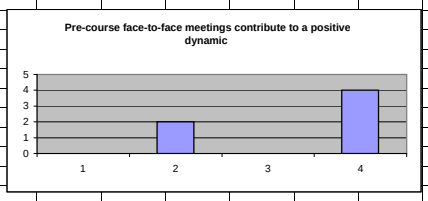
The use of another facilitator at the remote site is essential

12	Remote Facilitator	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6				1
		0	1	3	2



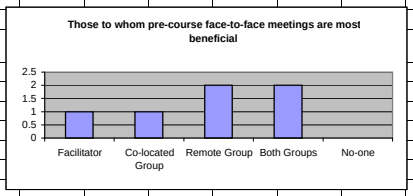
Pre-course face-to-face meetings contribute to a positive dynamic

13	Pre Meetings	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3				1
	Facilitator 4				1
	Facilitator 5				1
	Facilitator 6		1		
		0	2	0	4



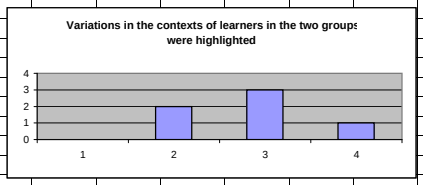
To whom do you think pre-course face-to-face meetings are most beneficial?

14	s	Facilitator	Co-located Group	Remote Group	Both Groups	No-one
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3			1		
	Facilitator 4	1			1	
	Facilitator 5			1		
	Facilitator 6					
		1	1	2	2	0



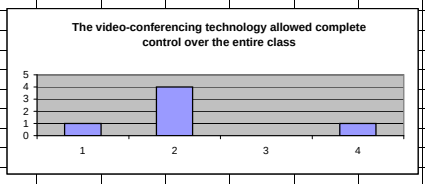
Variations in the contexts of learners in the two groups were highlighted

15	Variations	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3		1		
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6			1	
		0	2	3	1



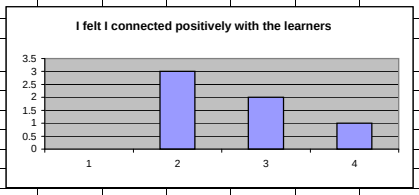
The video-conferencing technology allowed complete control over the entire class

16	Control	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3	1			
	Facilitator 4		1		
	Facilitator 5		1		
	Facilitator 6		1		
		1	4	0	1

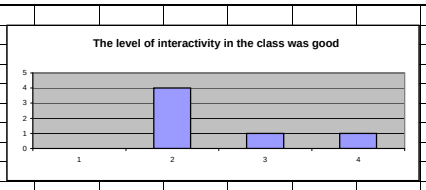


I felt I connected positively with the learners.

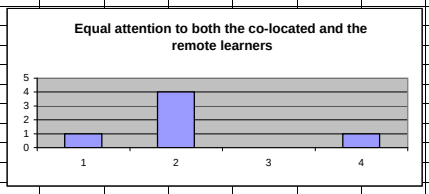
17	Positive Connection	1	2	3	4
	Facilitator 1				1
	Facilitator 2		1		
	Facilitator 3		1		
	Facilitator 4			1	
	Facilitator 5		1		
	Facilitator 6			1	
		0	3	2	1



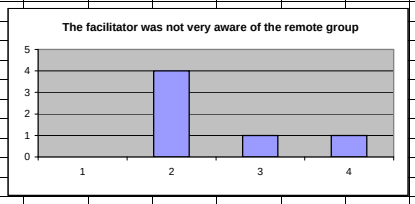
	The level of interactivity in the class was good.					
18	**Interactivity**	1	2	3	4	
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3		1			
	Facilitator 4		1			
	Facilitator 5		1			
	Facilitator 6			1		
		0	4	1	1	



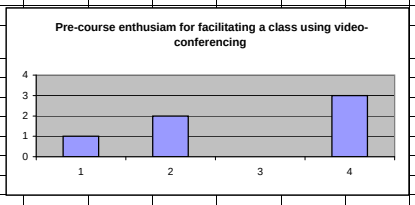
	Equal attention to both the co-located and the remote learners					
19	**Attention**	1	2	3	4	
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3		1			
	Facilitator 4		1			
	Facilitator 5	1				
	Facilitator 6		1			
		1	4	0	1	



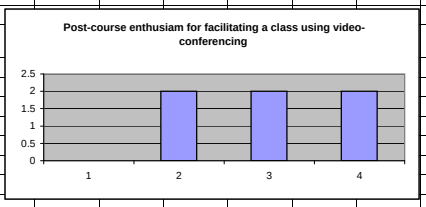
	The facilitator was not very aware of the remote group					
20	**Awareness**	1	2	3	4	
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3		1			
	Facilitator 4		1			
	Facilitator 5		1			
	Facilitator 6			1		
		0	4	1	1	



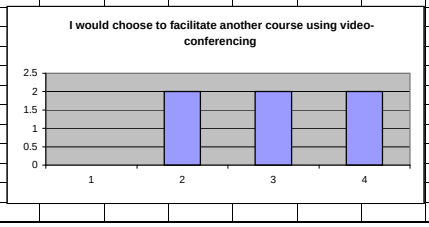
	Pre-course enthusiam for facilitating a class using video-conferencing					
21	**Pre-course enthusiam**	1	2	3	4	
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3		1			
	Facilitator 4				1	
	Facilitator 5				1	
	Facilitator 6	1				
		1	2	0	3	



	Post-course enthusiam for facilitating a class using video-conferencing					
22	**Post-course enthusiam**	1	2	3	4	
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3		1			
	Facilitator 4			1		
	Facilitator 5			1		
	Facilitator 6				1	
		0	2	2	2	



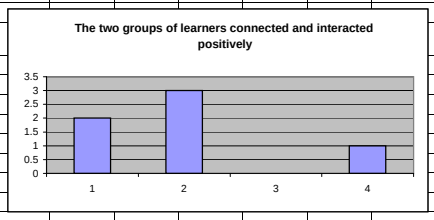
	I would choose to facilitate another course using video-conferencing					
23	**Again?**	1	2	3	4	
	Facilitator 1				1	
	Facilitator 2		1			
	Facilitator 3		1			
	Facilitator 4			1		
	Facilitator 5			1		
	Facilitator 6				1	
		0	2	2	2	



Facilitator's impressions of the attitudes and responses of learners

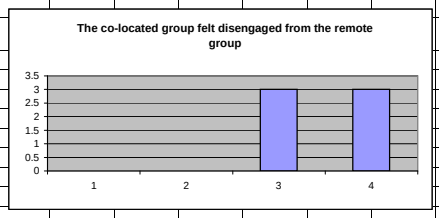
The two groups of learners connected and interacted positively.

24	Positive Interaction	1	2	3	4
	Facilitator 1			1	
	Facilitator 2	1			
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5	1			
	Facilitator 6				1
		2	3	0	1



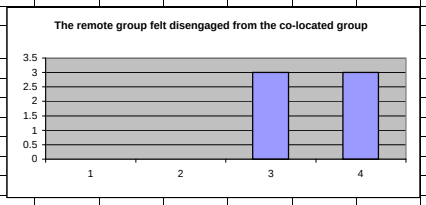
The co-located group felt disengaged from the remote group.

25	Disengaged - Co-located	1	2	3	4
	Facilitator 1				1
	Facilitator 2				1
	Facilitator 3			1	
	Facilitator 4				1
	Facilitator 5				1
	Facilitator 6			1	
		0	0	3	3



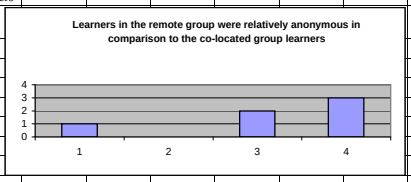
The remote group felt disengaged from the co-located group.

26	Disengaged - Remote	1	2	3	4
	Facilitator 1				1
	Facilitator 2				1
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5				1
	Facilitator 6			1	
		0	0	3	3



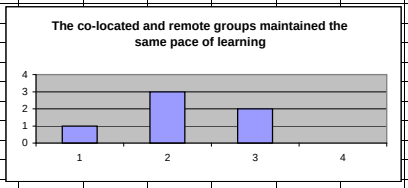
Learners in the remote group were relatively anonymous in comparison to the co-located group learners

27	Anonymity - Remote	1	2	3	4
	Facilitator 1				1
	Facilitator 2				1
	Facilitator 3				1
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6	1			
		1	0	2	3



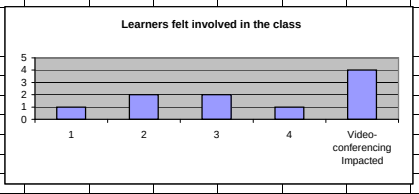
The co-located and remote groups maintained the same pace of learning.

28	Pace	1	2	3	4
	Facilitator 1				1
	Facilitator 2	1			
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6				1
		1	3	2	0



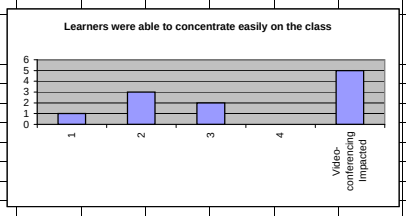
Learners felt involved in the class

29-a	Involvement - L	1	2	3	4	Video-conferencing Impacted
	Facilitator 1				1	
	Facilitator 2	1				1
	Facilitator 3			1		1
	Facilitator 4			1		1
	Facilitator 5				1	
	Facilitator 6				1	1
		1	2	2	1	4



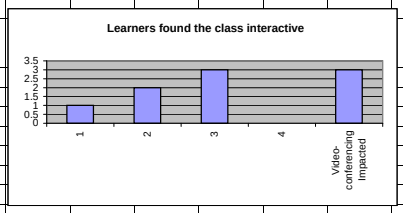
Learners were able to concentrate easily on the class

29-b	Concentration - F	1	2	3	4	Video-conferencing Impacted
	Facilitator 1		1			1
	Facilitator 2	1				1
	Facilitator 3		1			1
	Facilitator 4		1			1
	Facilitator 5			1		
	Facilitator 6			1		1
		1	3	2	0	5



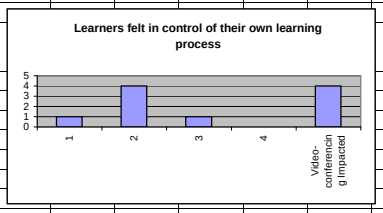
Learners found the class interactive

29-c	Perceived as Interactive - L	1	2	3	4	Video-conferencing Impacted
	Facilitator 1		1			
	Facilitator 2	1				1
	Facilitator 3			1		
	Facilitator 4		1			1
	Facilitator 5			1		
	Facilitator 6			1		1
		1	2	3	0	3



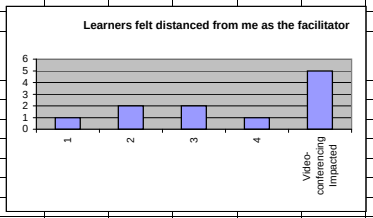
Learners felt in control of their own learning process

29-d	Control - L	1	2	3	4	Video-conferencing Impacted
	Facilitator 1		1			
	Facilitator 2	1				1
	Facilitator 3		1			1
	Facilitator 4		1			1
	Facilitator 5		1			
	Facilitator 6			1		1
		1	4	1	0	4



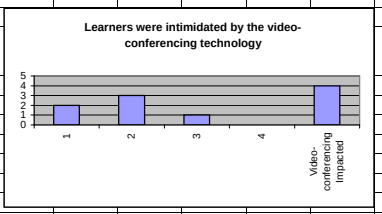
Learners felt distanced from me as the facilitator

29-e	Distanced from Facilitator - L	1	2	3	4	Video-conferencing Impacted
	Facilitator 1			1		1
	Facilitator 2	1				1
	Facilitator 3				1	1
	Facilitator 4			1		1
	Facilitator 5		1			
	Facilitator 6		1			1
		1	2	2	1	5



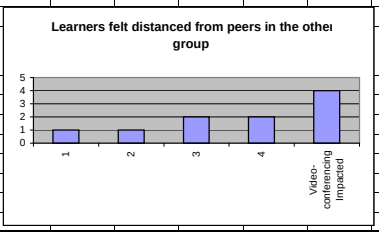
Learners were intimidated by the video-conferencing technology

29-f	Imtimidated - L	1	2	3	4	Video-conferencing Impacted
	Facilitator 1		1			
	Facilitator 2		1			1
	Facilitator 3	1				1
	Facilitator 4		1			1
	Facilitator 5	1				
	Facilitator 6			1		1
		2	3	1	0	4



Learners felt distanced from peers in the other group.

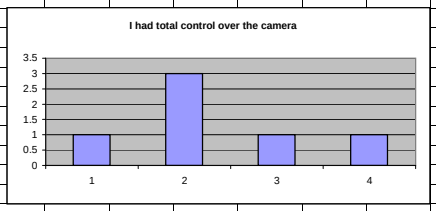
29-g	Distanced from Peers - L	1	2	3	4	Video-conferencing Impacted
	Facilitator 1			1		
	Facilitator 2				1	1
	Facilitator 3				1	1
	Facilitator 4			1		1
	Facilitator 5	1				1
	Facilitator 6		1			
		1	1	2	2	4



Technical issues

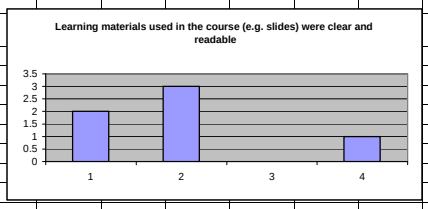
I had total control over the camera

30	**Camera Control**	1	2	3	4
	Facilitator 1		1		
	Facilitator 2				1
	Facilitator 3		1		
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6			1	
		1	3	1	1



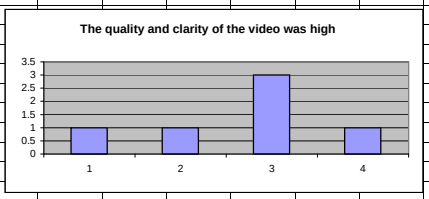
Learning materials used in the course (e.g. slides) were clear and readable.

31	**Clarity of Materials**	1	2	3	4
	Facilitator 1				1
	Facilitator 2	1			
	Facilitator 3		1		
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6		1		
		2	3	0	1



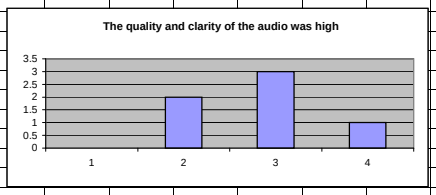
The quality and clarity of the video was high.

32	**Video Q & C**	1	2	3	4
	Facilitator 1			1	
	Facilitator 2				1
	Facilitator 3			1	
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6			1	
		1	1	3	1



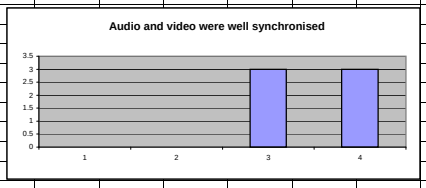
The quality and clarity of the audio was high.

33	**Audio Q & C**	1	2	3	4
	Facilitator 1			1	
	Facilitator 2			1	
	Facilitator 3				1
	Facilitator 4		1		
	Facilitator 5		1		
	Facilitator 6			1	
		0	2	3	1



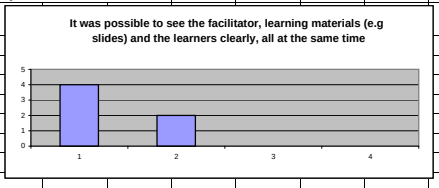
Audio and video were well synchronised.

34	**Synchronisation**	1	2	3	4
	Facilitator 1			1	
	Facilitator 2				1
	Facilitator 3				1
	Facilitator 4			1	
	Facilitator 5				1
	Facilitator 6			1	
		0	0	3	3



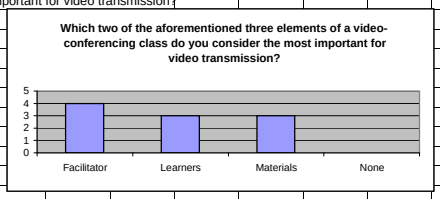
It was possible to see the facilitator, learning materials (e.g. slides) and the learners clearly, all at the same time

35	**Range of Materials**	1	2	3	4
	Facilitator 1			1	
	Facilitator 2	1			
	Facilitator 3	1			
	Facilitator 4			1	
	Facilitator 5	1			
	Facilitator 6	1			
		4	2	0	0



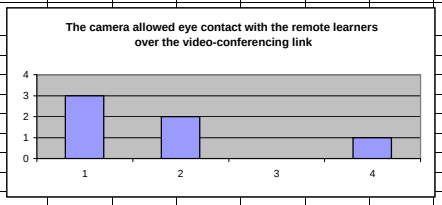
Which two of the facilitator, learners and learning materials do you consider the most important for video transmission?

36	Elements	Facilitator	Learners	Materials	None
	Facilitator 1	1			
	Facilitator 2		1	1	
	Facilitator 3	1		1	
	Facilitator 4	1	1		
	Facilitator 5			1	
	Facilitator 6	1	1		
		4	3	3	0



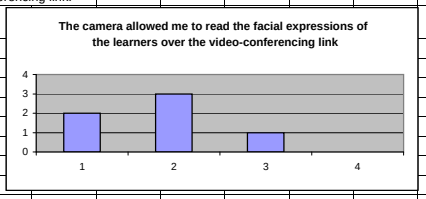
The camera allowed eye contact with the remote learners over the video-conferencing link.

37	Camera - Eye Contact	1	2	3	4
	Facilitator 1	1			
	Facilitator 2	1			
	Facilitator 3				1
	Facilitator 4		1		
	Facilitator 5	1			
	Facilitator 6		1		
		3	2	0	1



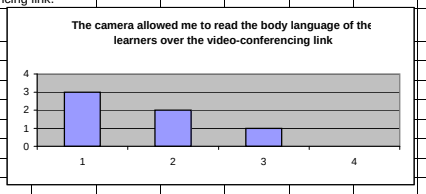
The camera allowed me to read the facial expressions of the learners over the video-conferencing link.

38	Camera - Facial Expressions	1	2	3	4
	Facilitator 1	1			
	Facilitator 2	1			
	Facilitator 3			1	
	Facilitator 4		1		
	Facilitator 5		1		
	Facilitator 6		1		
		2	3	1	0



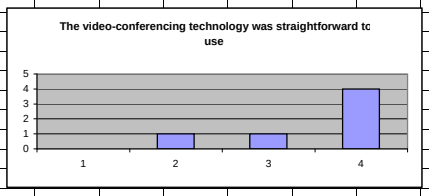
The camera allowed me to read the body language of the learners over the video-conferencing link.

39	Camera - Body Language	1	2	3	4
	Facilitator 1	1			
	Facilitator 2	1			
	Facilitator 3		1		
	Facilitator 4			1	
	Facilitator 5		1		
	Facilitator 6	1			
		3	2	1	0



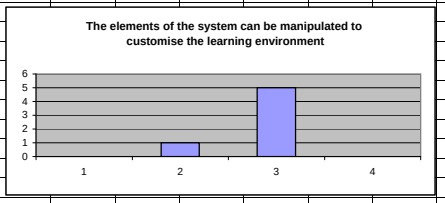
The video-conferencing technology was straightforward to use.

40	VC Simplicity	1	2	3	4
	Facilitator 1			1	
	Facilitator 2				1
	Facilitator 3				1
	Facilitator 4		1		
	Facilitator 5				1
	Facilitator 6				1
		0	1	1	4



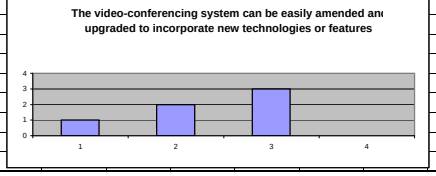
The elements of the system can be manipulated to customise the learning environment.

41	Customisability	1	2	3	4
	Facilitator 1			1	
	Facilitator 2			1	
	Facilitator 3		1		
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6			1	
		0	1	5	0



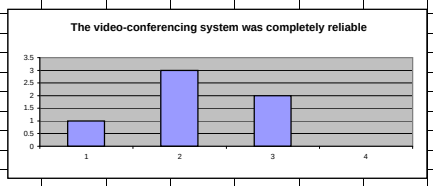
The video-conferencing system can be easily amended and upgraded to incorporate new technologies or features.

42	Upgradable	1	2	3	4
	Facilitator 1		1		
	Facilitator 2			1	
	Facilitator 3	1			
	Facilitator 4			1	
	Facilitator 5		1		
	Facilitator 6			1	
		1	2	3	0



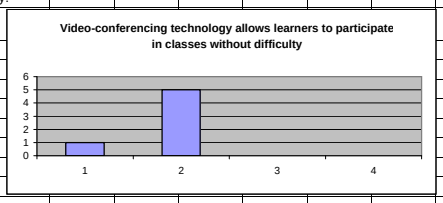
The video-conferencing system was completely reliable.

43	Reliable	1	2	3	4
	Facilitator 1			1	
	Facilitator 2				1
	Facilitator 3				1
	Facilitator 4			1	
	Facilitator 5	1			
	Facilitator 6			1	
		1		3	2	0



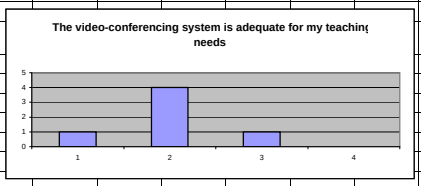
Video-conferencing technology allows learners to participate in classes without difficulty.

44	Participation Ease	1	2	3	4
	Facilitator 1			1	
	Facilitator 2	1			
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6			1	
		1		5	0	0



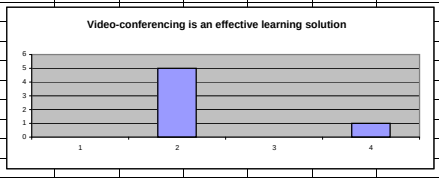
The video-conferencing system is adequate for my teaching needs.

45	System Adequate	1	2	3	4
	Facilitator 1			1	
	Facilitator 2	1			
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6				1
		1		4	1	0



Video-conferencing is an effective learning solution.

46	Effective	1	2	3	4
	Facilitator 1			1	
	Facilitator 2			1	
	Facilitator 3			1	
	Facilitator 4			1	
	Facilitator 5			1	
	Facilitator 6				1
		0		5	0	1



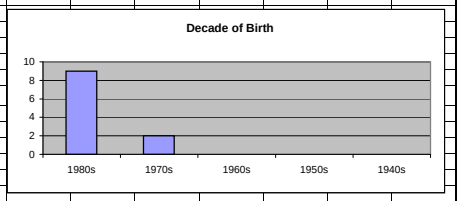
47	Comments	
	Facilitator 1	The remote group visited two-at-a-time for the 4 week course, and they operated the local/remote setup and contributed to its smooth use. This reduced my need to be directly involved, which may in turn have reduced my interaction/responsibility for the remote students.
	Facilitator 2	Q31. Websites were not easily readable at the remote site. This is a major issue – their link was too slow to log into some sites and when it was fast enough, not visible by all. Q46. A relevant case study would be Open University in the UK. The use video tapes rather than video conferencing. I wonder why? Perhaps video-conferencing is best for just that – conferencing, not learning.
	Facilitator 5	My responses are going to look like they are putting down video-conferencing as a teaching option. In comparison to face-to-face interaction, I find it sub-standard. In comparison to hours of traveling, video-conferencing is a giant leap forward!
	Facilitator 6	The diversity of the group of learners in two locations aided my course – because of the nature of the course, HCI requires diverse cultures to enable specific concepts to be fully understood.

Video Conferencing Questionnaire Results - Participants

Profile

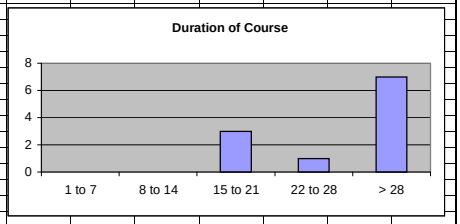
In which decade were you born?

	Decade	1980s	1970s	1960s	1950s	1940s
1	Participant 1	1				
	Participant 2	1				
	Participant 3	1				
	Participant 4	1				
	Participant 5	1				
	Participant 6	1				
	Participant 7	1				
	Participant 8	1				
	Participant 9	1				
	Participant 10		1			
	Participant 11		1			
		9	2	0	0	0



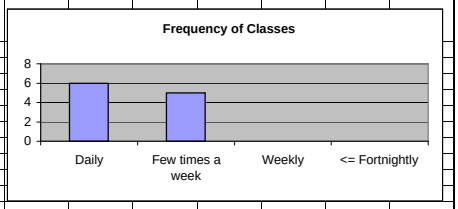
What was the duration of your video-conferencing course?

	Duration	1 to 7	8 to 14	15 to 21	22 to 28	> 28
2	Participant 1			1		
	Participant 2			1		
	Participant 3			1		
	Participant 4					1
	Participant 5				1	
	Participant 6					1
	Participant 7					1
	Participant 8					1
	Participant 9					1
	Participant 10					1
	Participant 11					1
		0	0	3	1	7



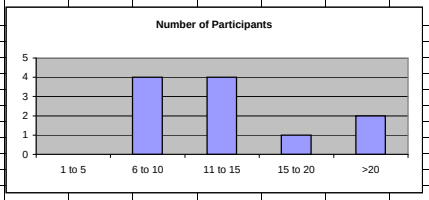
How frequently were classes held in your video-conferencing course?

	Frequency	Daily	Few times a week	Weekly	<= Fortnightly
3	Participant 1	1			
	Participant 2	1			
	Participant 3		1		
	Participant 4	1			
	Participant 5	1			
	Participant 6	1			
	Participant 7		1		
	Participant 8		1		
	Participant 9		1		
	Participant 10	1			
	Participant 11		1		
		6	5	0	0



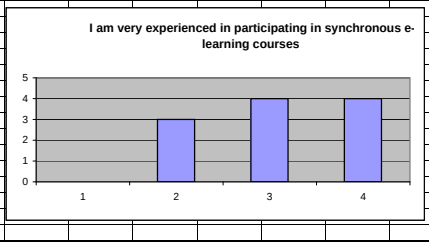
What was the average number of students taking part in your video-conferencing course (including yourself)?

	Number of Participants	1 to 5	6 to 10	11 to 15	15 to 20	>20
4	Participant 1					1
	Participant 2					1
	Participant 3			1		
	Participant 4			1		
	Participant 5				1	
	Participant 6			1		
	Participant 7		1			
	Participant 8			1		
*	Participant 9		1			
	Participant 10		1			
	Participant 11		1			
		0	4	4	1	2



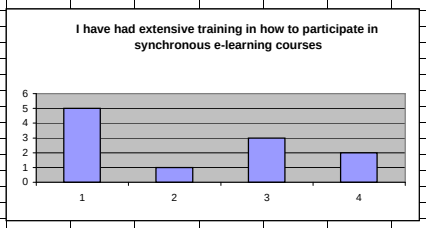
I am very experienced in participating in synchronous e-learning courses

	Experience	1	2	3	4	
5	Participant 1				1	
	Participant 2				1	
	Participant 3		1			
	Participant 4		1			
	Participant 5			1		
	Participant 6		1			
	Participant 7			1		
	Participant 8			1		
	Participant 9			1		
	Participant 10				1	
	Participant 11				1	
		0	3	4	4	



I have had extensive training in how to participate in synchronous e-learning courses

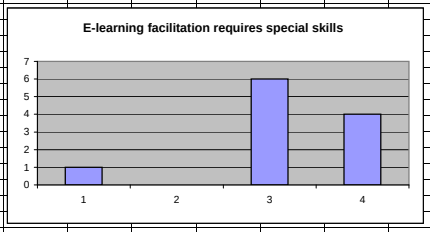
	Training	1	2	3	4
	Participant 1	1			
	Participant 2				1
	Participant 3		1		
	Participant 4	1			
	Participant 5	1			
	Participant 6	1			
	Participant 7			1	
	Participant 8			1	
	Participant 9	1			
	Participant 10				1
	Participant 11			1	
		5	1	3	2



Learners' opinions and attitudes about the role of the facilitator in video-conferencing

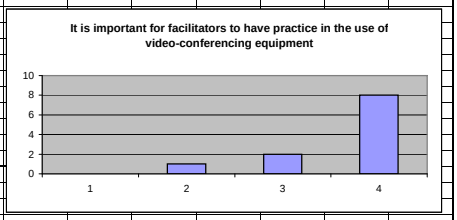
E-learning facilitation requires special skills

	Skills	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3			1	
	Participant 4			1	
	Participant 5			1	
	Participant 6				1
	Participant 7			1	
	Participant 8	1			
	Participant 9			1	
	Participant 10				1
	Participant 11			1	
		1	0	6	4



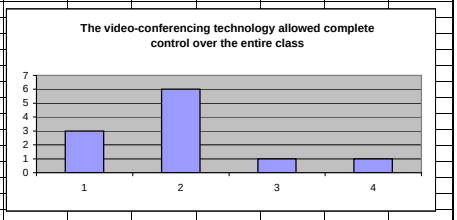
It is important for facilitators to have practice using VC equipment

	Practice - F	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3			1	
	Participant 4				1
	Participant 5				1
	Participant 6				1
	Participant 7				1
	Participant 8		1		
	Participant 9				1
	Participant 10			1	
	Participant 11				1
		0	1	2	8



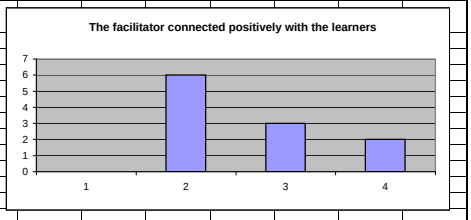
The video-conferencing technology allowed complete control over the entire class

	Control	1	2	3	4
	Participant 1		1		
	Participant 2			1	
	Participant 3		1		
	Participant 4	1			
	Participant 5		1		
	Participant 6		1		
	Participant 7		1		
	Participant 8	1			
	Participant 9	1			
	Participant 10				1
	Participant 11		1		
		3	6	1	1



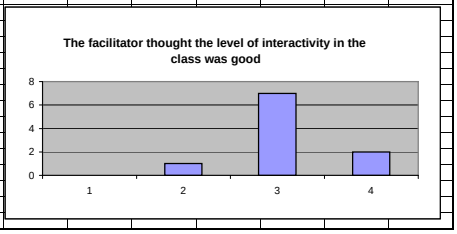
The facilitator connected positively with the learners.

	Positive Connection	1	2	3	4
	Participant 1		1		
	Participant 2			1	
	Participant 3			1	
	Participant 4			1	
	Participant 5		1		
	Participant 6		1		
	Participant 7		1		
	Participant 8				1
	Participant 9		1		
	Participant 10				1
	Participant 11		1		
		0	6	3	2



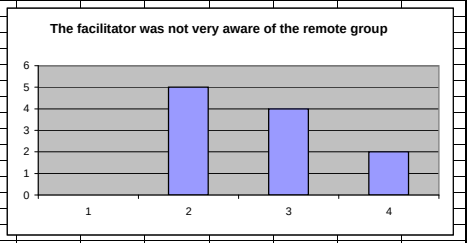
The facilitator thought the level of interactivity in the class was good.

	Interactivity	1	2	3	4
	Participant 1			1	
	Participant 2				1
	Participant 3		1		
	Participant 4			1	
	Participant 5			1	
	Participant 6			1	
	Participant 7			1	
	Participant 8				
	Participant 9			1	
	Participant 10				1
	Participant 11			1	
		0	1	7	2



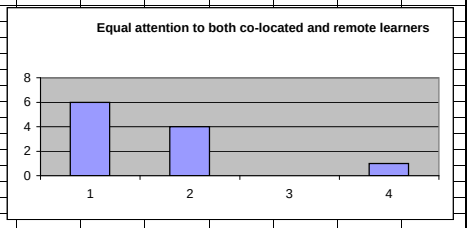
The facilitator was not very aware of the remote group

	Awareness	1	2	3	4
	Participant 1			1	
	Participant 2		1		
	Participant 3			1	
	Participant 4		1		
	Participant 5		1		
	Participant 6			1	
	Participant 7		1		
	Participant 8				1
	Participant 9		1		
	Participant 10				1
	Participant 11			1	
		0	5	4	2



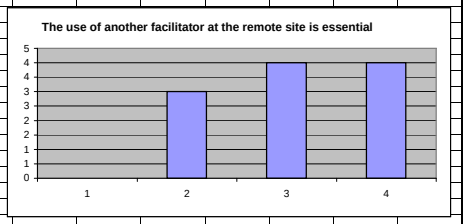
Equal attention to both the co-located and the remote learners

	Attention	1	2	3	4
	Participant 1		1		
	Participant 2	1			
	Participant 3	1			
	Participant 4	1			
	Participant 5		1		
	Participant 6	1			
	Participant 7		1		
	Participant 8	1			
	Participant 9		1		
	Participant 10				1
	Participant 11	1			
		6	4	0	1



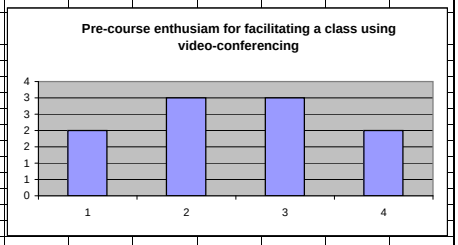
The use of another facilitator at the remote site is essential

	Remote Facilitator	1	2	3	4
	Participant 1				1
	Participant 2		1		
	Participant 3			1	
	Participant 4		1		
	Participant 5			1	
	Participant 6				1
	Participant 7		1		
	Participant 8				1
	Participant 9				1
	Participant 10			1	
	Participant 11			1	
		0	3	4	4



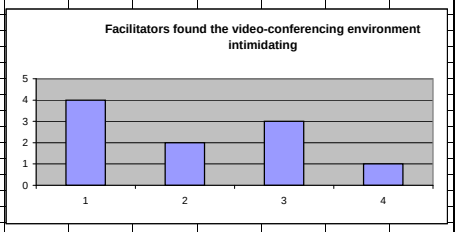
Pre-course enthusiam for facilitating a class using video-conferencing

	Pre-course enthusiam	1	2	3	4
	Participant 1		1		
	Participant 2				
	Participant 3		1		
	Participant 4		1		
	Participant 5			1	
	Participant 6	1			
	Participant 7			1	
	Participant 8	1			
	Participant 9				1
	Participant 10				1
	Participant 11			1	
		2	3	3	2



Facilitator found the video-conferencing environment intimidating

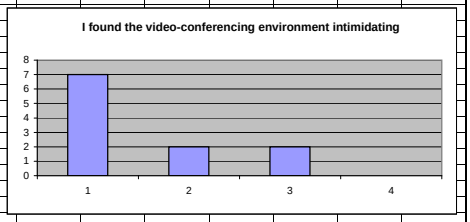
	Intimidating	1	2	3	4
	Participant 1				1
	Participant 2				
	Participant 3		1		
	Participant 4		1		
	Participant 5	1			
	Participant 6	1			
	Participant 7			1	
	Participant 8	1			
	Participant 9			1	
	Participant 10	1			
	Participant 11			1	
		4	2	3	1



Learners opinions and attitudes about video-conferencing

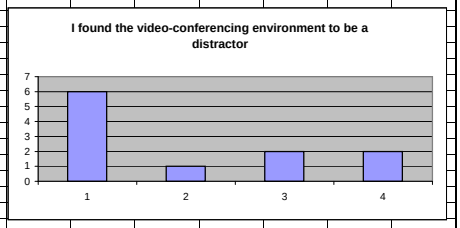
I found the video-conferencing environment intimidating

	Intimidating	1	2	3	4
	Participant 1	1			
	Participant 2	1			
	Participant 3		1		
	Participant 4		1		
	Participant 5	1			
	Participant 6			1	
	Participant 7			1	
	Participant 8	1			
	Participant 9	1			
	Participant 10	1			
	Participant 11	1			
		7	2	2	0



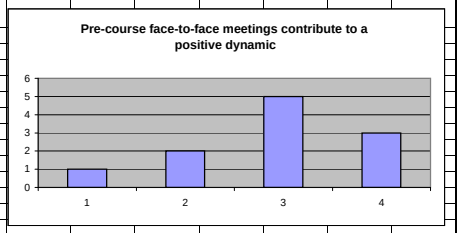
I found the video-conferencing environment to be a distractor

	Distractor	1	2	3	4
	Participant 1			1	
	Participant 2		1		
	Participant 3	1			
	Participant 4				1
	Participant 5	1			
	Participant 6			1	
	Participant 7	1			
	Participant 8				1
	Participant 9	1			
	Participant 10	1			
	Participant 11	1			
		6	1	2	2



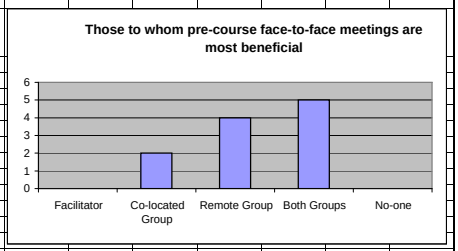
Pre-course face-to-face meetings contribute to a positive dynamic

	Pre MeetParticipant 1	1	2	3	4
	Participant 1			1	
	Participant 2		1		
	Participant 3				1
	Participant 4			1	
	Participant 5		1		
	Participant 6				1
	Participant 7			1	
	Participant 8				1
	Participant 9			1	
	Participant 10	1			
	Participant 11			1	
		1	2	5	3



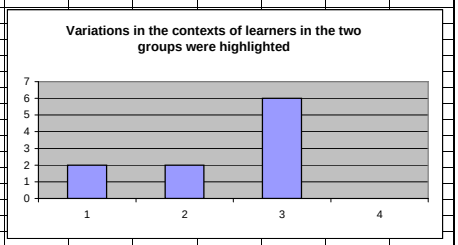
To whom do you think pre-course face-to-face meetings are most beneficial?

	Pre Meeting Benefits	Facilitator	Co-located Group	Remote Group	Both Groups	No-one
	Participant 1			1		
	Participant 2		1			
	Participant 3			1		
	Participant 4				1	
	Participant 5			1		
	Participant 6				1	
	Participant 7		1			
	Participant 8				1	
	Participant 9				1	
	Participant 10				1	
	Participant 11			1		
		0	2	4	5	0



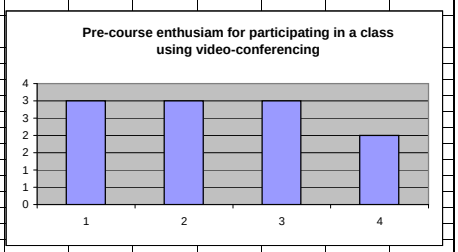
Variations in the contexts of learners in the two groups were highlighted

	Variations	1	2	3	4
	Participant 1			1	
	Participant 2			1	
	Participant 3			1	
	Participant 4			1	
	Participant 5		1		
	Participant 6				
	Participant 7		1		
	Participant 8	1			
	Participant 9	1			
	Participant 10			1	
	Participant 11			1	
		2	2	6	0



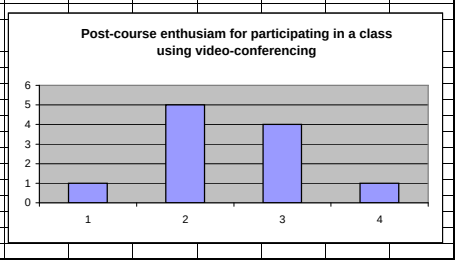
Pre-course enthusiam for participating in a class using video-conferencing

	Pre-course enthusiam	1	2	3	4
	Participant 1		1		
	Participant 2		1		
	Participant 3			1	
	Participant 4			1	
	Participant 5			1	
	Participant 6		1		
	Participant 7	1			
	Participant 8	1			
	Participant 9				1
	Participant 10	1			
	Participant 11				1
		3	3	3	2



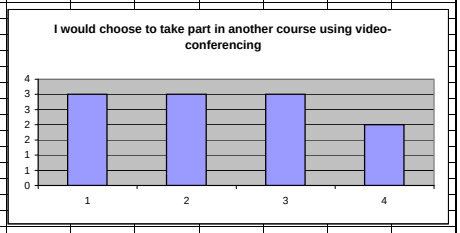
Post-course enthusiam for participating in a class using video-conferencing

	Post-course enthusiam	1	2	3	4
	Participant 1		1		
	Participant 2		1		
	Participant 3			1	
	Participant 4		1		
	Participant 5		1		
	Participant 6			1	
	Participant 7			1	
	Participant 8	1			
	Participant 9			1	
	Participant 10		1		
	Participant 11				1
		1	5	4	1



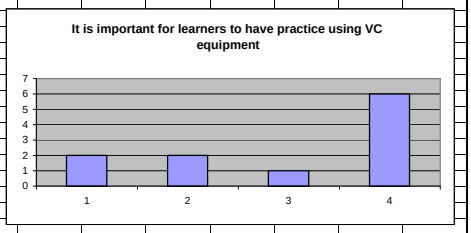
I would choose to take part in another course using video-conferencing

24	Again?	1	2	3	4
	Participant 1			1	
	Participant 2				1
	Participant 3			1	
	Participant 4	1			
	Participant 5			1	
	Participant 6			1	
	Participant 7	1			
	Participant 8	1			
	Participant 9			1	
	Participant 10			1	
	Participant 11				1
		3	3	3	2



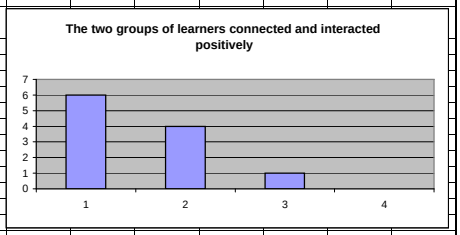
It is important for learners to have practice using VC equipment

25	Practice - L	1	2	3	4
	Participant 1			1	
	Participant 2				1
	Participant 3		1		
	Participant 4		1		
	Participant 5				1
	Participant 6	1			
	Participant 7				1
	Participant 8				1
	Participant 9				1
	Participant 10	1			
	Participant 11				1
		2	2	1	6



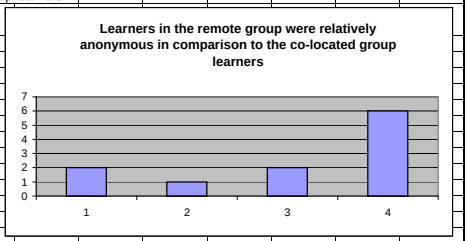
The two groups of learners connected and interacted positively.

26	Positive Interaction	1	2	3	4
	Participant 1	1			
	Participant 2		1		
	Participant 3	1			
	Participant 4	1			
	Participant 5			1	
	Participant 6	1			
	Participant 7		1		
	Participant 8	1			
	Participant 9		1		
	Participant 10		1		
	Participant 11	1			
		6	4	1	0



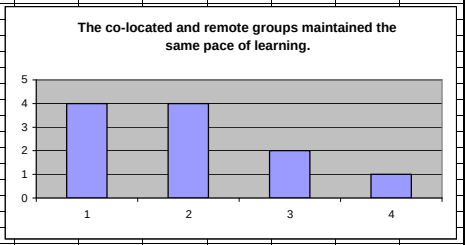
Learners in the remote group were relatively anonymous in comparison to the co-located group learners

27	Anonymity - Remote	1	2	3	4
	Participant 1				1
	Participant 2			1	
	Participant 3				1
	Participant 4	1			
	Participant 5				1
	Participant 6				1
	Participant 7				1
	Participant 8				1
	Participant 9	1			
	Participant 10		1		
	Participant 11			1	
		2	1	2	6



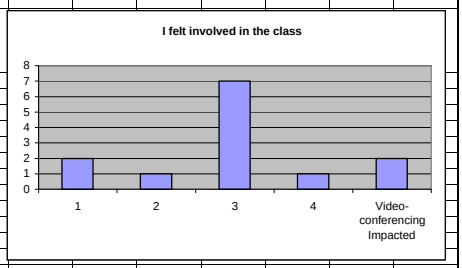
The co-located and remote groups maintained the same pace of learning.

28	Pace	1	2	3	4
	Participant 1		1		
	Participant 2		1		
	Participant 3		1		
	Participant 4		1		
	Participant 5			1	
	Participant 6	1			
	Participant 7	1			
	Participant 8	1			
	Participant 9				1
	Participant 10			1	
	Participant 11	1			
		4	4	2	1



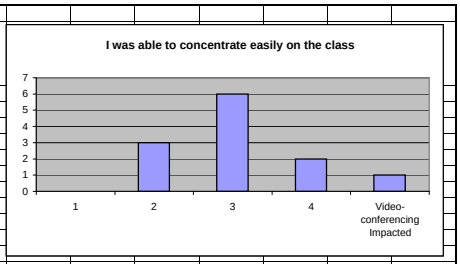
I felt involved in the class

29-a	Involvement - L	1	2	3	4	Video-conferencing Impacted
	Participant 1			1		
	Participant 2				1	
	Participant 3			1		
	Participant 4			1		
	Participant 5			1		
	Participant 6			1		
	Participant 7			1		
	Participant 8	1				
	Participant 9	1				1
	Participant 10		1			
	Participant 11			1		1
		2	1	7	1	2



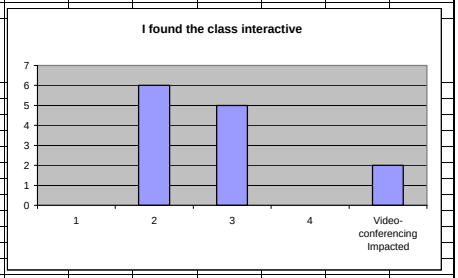
I was able to concentrate easily on the class

29-b	Concentration - F	1	2	3	4	Video-conferencing Impacted
	Participant 1			1		
	Participant 2				1	
	Participant 3			1		
	Participant 4			1		
	Participant 5				1	
	Participant 6			1		
	Participant 7		1			
	Participant 8			1		
	Participant 9		1			1
	Participant 10			1		
	Participant 11		1			
		0	3	6	2	1



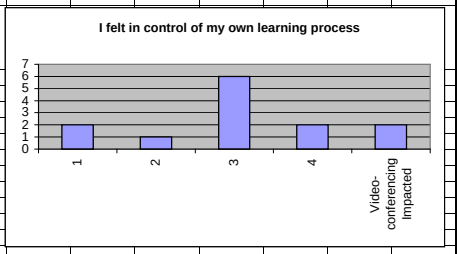
I found the class interactive

29-c	Perceived as Interactive - L	1	2	3	4	Video-conferencing Impacted
	Participant 1			1		
	Participant 2			1		1
	Participant 3			1		
	Participant 4			1		
	Participant 5			1		
	Participant 6			1		
	Participant 7		1			
	Participant 8		1			
	Participant 9		1			
	Participant 10		1			
	Participant 11		1			1
		0	6	5	0	2



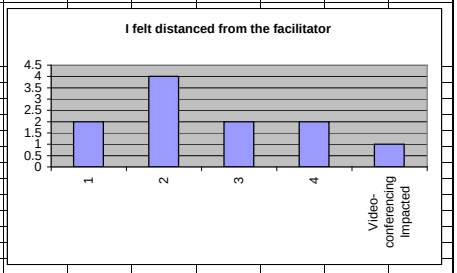
I felt in control of my own learning process

29-d	Control - L	1	2	3	4	Video-conferencing Impacted
	Participant 1			1		
	Participant 2				1	
	Participant 3			1		
	Participant 4			1		
	Participant 5			1		
	Participant 6	1				
	Participant 7		1			
	Participant 8	1				
	Participant 9			1		1
	Participant 10			1		
	Participant 11				1	1
		2	1	6	2	2



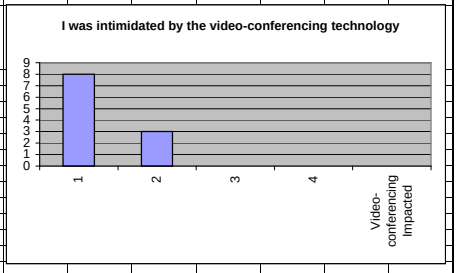
I felt distanced from the facilitator

29-e	Distanced from Facilitator - L	1	2	3	4	Video-conferencing Impacted
	Participant 1		1			
	Participant 2	1				
	Participant 3		1			
	Participant 4			1		
	Participant 5	1				
	Participant 6			1		
	Participant 7					1
	Participant 8				1	
	Participant 9				1	
	Participant 10		1			
	Participant 11		1			
		2	4	2	2	1



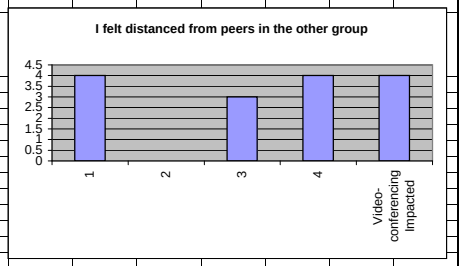
I was intimidated by the video-conferencing technology

29-f	Imtimidated - L	1	2	3	4	Video-conferencing Impacted
	Participant 1	1				
	Participant 2	1				
	Participant 3		1			
	Participant 4		1			
	Participant 5	1				
	Participant 6	1				
	Participant 7		1			
	Participant 8	1				
	Participant 9	1				
	Participant 10	1				
	Participant 11	1				
		8	3	0	0	0



I felt distanced from peers in the other group.

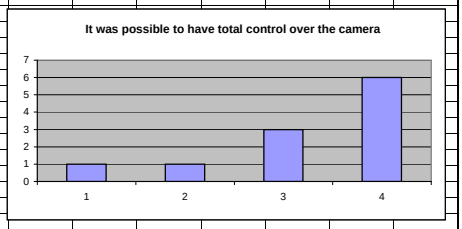
29-g	Distanced from Peers - L	1	2	3	4	Video-conferencing Impacted
	Participant 1	1				
	Participant 2	1				
	Participant 3			1		1
	Participant 4				1	1
	Participant 5			1		
	Participant 6				1	1
	Participant 7			1		
	Participant 8				1	
	Participant 9				1	1
	Participant 10	1				
	Participant 11	1				
		4	0	3	4	4



Technical issues

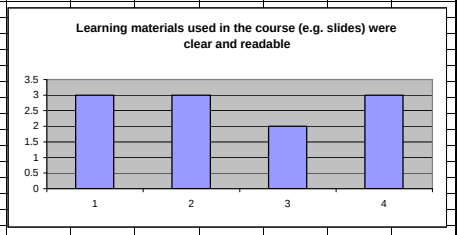
It was possible to have total control over the camera

30	Camera Control	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3			1	
	Participant 4		1		
	Participant 5			1	
	Participant 6				1
	Participant 7			1	
	Participant 8	1			
	Participant 9				1
	Participant 10				1
	Participant 11				1
		1	1	3	6



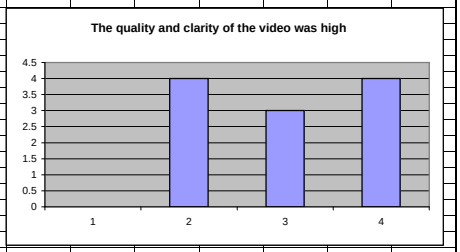
Learning materials used in the course (e.g. slides) were clear and readable.

31	Clarity of Materials	1	2	3	4
	Participant 1				1
	Participant 2		1		
	Participant 3		1		
	Participant 4		1		
	Participant 5	1			
	Participant 6				1
	Participant 7	1			
	Participant 8	1			
	Participant 9			1	
	Participant 10				1
	Participant 11			1	
		3	3	2	3



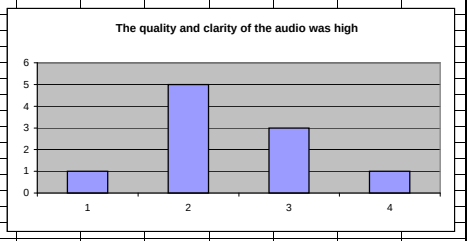
The quality and clarity of the video was high.

32	Video Q & C	1	2	3	4
	Participant 1			1	
	Participant 2				1
	Participant 3		1		
	Participant 4		1		
	Participant 5		1		
	Participant 6			1	
	Participant 7		1		
	Participant 8				1
	Participant 9				1
	Participant 10				1
	Participant 11			1	
		0	4	3	4



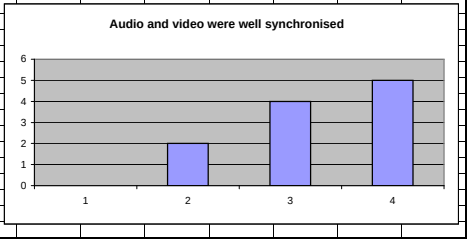
The quality and clarity of the audio was high.

33	Audio Q & C	1	2	3	4
	Participant 1			1	
	Participant 2		1		
	Participant 3		1		
	Participant 4	1			
	Participant 5		1		
	Participant 6		1		
	Participant 7			1	
	Participant 8			1	
	Participant 9				
	Participant 10				1
	Participant 11		1		
		1	5	3	1



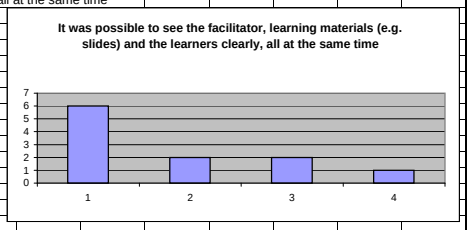
Audio and video were well synchronised.

34	Synchronisation	1	2	3	4
	Participant 1			1	
	Participant 2				1
	Participant 3			1	
	Participant 4			1	
	Participant 5				1
	Participant 6		1		
	Participant 7		1		
	Participant 8				1
	Participant 9				1
	Participant 10				1
	Participant 11			1	
		0	2	4	5



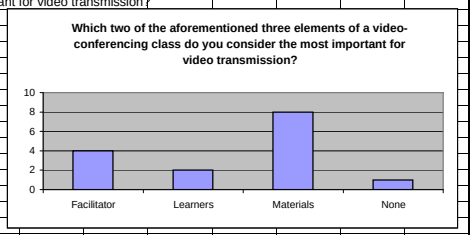
It was possible to see the facilitator, learning materials (e.g. slides) and the learners clearly, all at the same time

35	Range of Materials	1	2	3	4
	Participant 1			1	
	Participant 2	1			
	Participant 3	1			
	Participant 4		1		
	Participant 5			1	
	Participant 6	1			
	Participant 7		1		
	Participant 8	1			
	Participant 9	1			
	Participant 10				1
	Participant 11	1			
		6	2	2	1



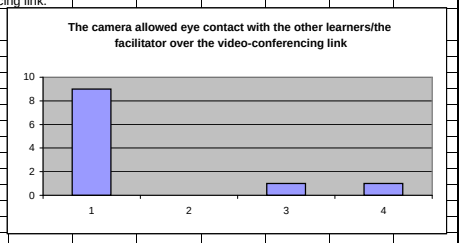
Which two of the facilitator, learners and learning materials do you consider the most important for video transmission?

36	Elements	Facilitator	Learners	Materials	None
	Participant 1	1		1	
	Participant 2			1	
	Participant 3				1
	Participant 4	1		1	
	Participant 5			1	
	Participant 6		1	1	
	Participant 7	1		1	
	Participant 8			1	
	Participant 9		1		
	Participant 10	1			
	Participant 11			1	
		4	2	8	1



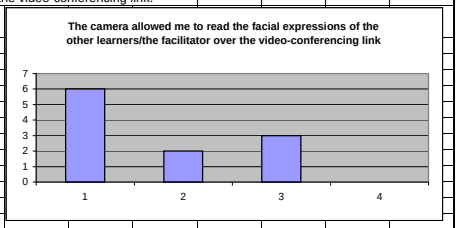
The camera allowed eye contact with the other learners/the facilitator over the video-conferencing link.

37	Camera - Eye Contact	1	2	3	4
	Participant 1	1			
	Participant 2	1			
	Participant 3	1			
	Participant 4	1			
	Participant 5	1			
	Participant 6	1			
	Participant 7			1	
	Participant 8	1			
	Participant 9	1			
	Participant 10				1
	Participant 11	1			
		9	0	1	1



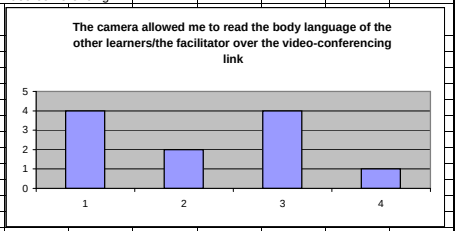
The camera allowed me to read the facial expressions of the other learners/the facilitator over the video-conferencing link.

38	Camera - Facial Expressions	1	2	3	4
	Participant 1		1		
	Participant 2	1			
	Participant 3	1			
	Participant 4	1			
	Participant 5			1	
	Participant 6	1			
	Participant 7			1	
	Participant 8	1			
	Participant 9		1		
	Participant 10			1	
	Participant 11	1			
		6	2	3	0



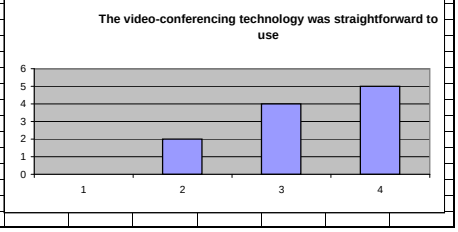
The camera allowed me to read the body language of the other learners/the facilitator over the video-conferencing link.

39	Camera - Body Language	1	2	3	4
	Participant 1			1	
	Participant 2	1			
	Participant 3		1		
	Participant 4	1			
	Participant 5			1	
	Participant 6	1			
	Participant 7			1	
	Participant 8	1			
	Participant 9			1	
	Participant 10				1
	Participant 11		1		
		4	2	4	1

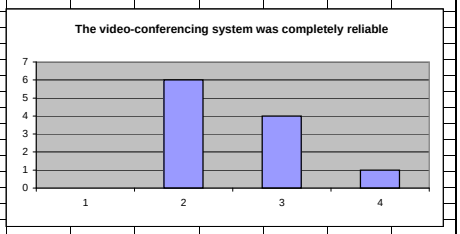


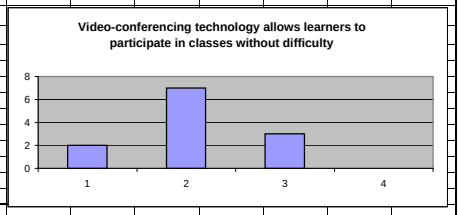
The video-conferencing technology was straightforward to use.

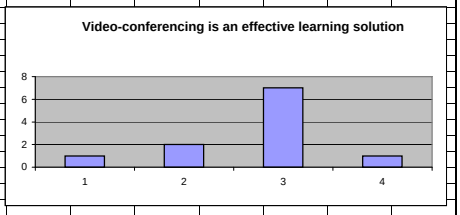
40	VC Simplicity	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3			1	
	Participant 4			1	
	Participant 5				1
	Participant 6				1
	Participant 7				1
	Participant 8				1
	Participant 9				1
	Participant 10				1
	Participant 11				1
		0	2	4	5



	The video-conferencing system was completely reliable.													
41	**Reliable**	1	2	3	4									
	Participant 1			1										
	Participant 2				1									
	Participant 3			1										
	Participant 4			1										
	Participant 5			1										
	Participant 6				1									
	Participant 7			1										
	Participant 8				1									
	Participant 9				1									
	Participant 10					1								
	Participant 11			1										
		0	6	4	1									
	Video-conferencing technology allows learners to participate in classes without difficulty.													
42	**Participation Ease**	1	2	3	4									
	Participant 1			1										
	Participant 2				1									
	Participant 3			1										
	Participant 4			1										
	Participant 5				1									
	Participant 6			1										
	Participant 7			1										
	Participant 8	1												
	Participant 9	1												
	Participant 10				1									
	Participant 11			2										
		2	7	3	0									
	Video-conferencing is an effective learning solution.													
43	**Effective**	1	2	3	4									
	Participant 1				1									
	Participant 2					1								
	Participant 3			1										
	Participant 4				1									
	Participant 5			1										
	Participant 6				1									
	Participant 7				1									
	Participant 8	1												
	Participant 9				1									
	Participant 10				1									
	Participant 11				1									
		1	2	7	1									
44	**Comments**													
	Participant 1	It might be useful to know that I was on the end with the video-conferencing equipment with the facilitator. So everything you want to see – the facilitator and notes were easy to see. Don't know how the other people felt on the other side. Often when you are on the same side as the facilitator you tend to ignore the remote class cos they are like flies on the wall or just other people watching you. So you don't reallt care about them and forget they are even there.													
	Participant 2	The main point of concern is that the faciliator needs to know how to use the video conference system. They cannot just walk in and start teach as if the remote class is just at the back of the co-located class, unless there is another facliator to handle the vid-conf systems. Audio quality is of prime importance as there is nthing worse then having difficulty hearing questions and answers. The idea of having your remote and co-located class meet IRL before hand or even just an introductionary session is soemthing I had nto considrered before but makes a lot of sense to me. You try harder to understand someone when they are not just a person who is inside a TV													
	Participant 6	While video-conferencing could be an effective learning solution a good interaction between learners at both remote and co-location could facilitate keeping the same pace. And this would make the learning experience more relaxed and enjoyable, rather than intimidating and unnecessarily formal (as if it were an interview)													
	Participant 7	Video-conferencing is a special technology that can be used for teaching although there are some negatives that I as a student did experience. The way the facilitator will be teaching is like faster than the speed I grab the content of the discussion. The voice usually be not synchronous with the video.													
	Participant 8	In my opinion video conferencing should not be used for teaching classes. The remote based students do not have equivalent interaction to those who are on site with the lecturer.													







Appendix D - LVC Survey Matrix

Product	Netbriefings eConference Pro	Horizon Wimba's Live Classroom	iLinc LearnLinc	Hewlett Packard Virtual Rooms	Elluminate Live!	Interwise ECP Connect	WebEx Training Center	Adobe Breeze	Avacast Avacaster	Microsoft Livemeeting	Webhuddle	Genesys Meeting Centre
Hosted externally/Local option	E	E	L	E	E	E	E	L	L	E	L	L
Plugin required	N	Y	N	Y	Y	Y	N	N	N	N	N	Y
Proprietary/Open Source	P	P	P	P	P	P	P	P	P	P	O	P
Pricing (1 yr,10-user LVC)	R 39,575.00	R 39,675.00	R 109,439.00	R 60,000.00	R 51,461.00	/	R 209,831.00	/	R 47,502.00	/	R 0.00	/
Audio - Half/Full Duplex	/	Full	Both	Full	Half	Full	Both		Full	Half -	Half	/
Set-up Wizard	Y	Y	N	Y	Y	Y	Y		Y	N	Y	/
Group chat	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Private Msging Facilitator	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Private Msging Other Participants	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y
Save Chat Transcript	N	Y	Y	Y	Y	Y	Y	N	Y	N	N	N
Transcript Includes Private Msging	/	N	N	N	Y	N	Y	N	Y	N	Y	N
Whiteboards	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Saving Whiteboards	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N
Printing Whiteboards			Y	Y		Y		Y	N	Y	N	N
Pasting/Importing Graphics	N	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y
Multiple Writers On Whiteboard	Unlimited	Y	Y	Y	Y	2	N	F	Y	Y	F	N
Annotations on Slides	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	F	Y
Annotations Saved On Past Whiteboards And Slides	Y	N	Y	Y	Y -Optional	Y	Y	N	Y	Y	Y	N
Drawings & Graphics (Incl. Text) Movable	Y	N	Y+	Y	Y	Y	N	Y	Y	Y	N	Y
Tools available	Many	Few	Many	Many	Few	Many	Limited	Many	Many	Many	Limited	
Survey/Polling Tools	Polls	Polls, MCQs, Free Response Qs	MCQs (or SurveyLinc/ TestLinc - not incl by default)	Polls, MCQs, Free Response Qs	Polls, MCQS	Polls, MCQs, Free reponse Qs, Surveys	MCQs, Free response Qs	MCQs	Polls and MCQs	MCQs	MCQs, Free response Qs	MCQs, Surveys
Results Sharable	Y - Instant	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Create Questions Spontaneously	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y
Anonimity of Feedback - Visible to Facilitator/All/None/Configurable	F	C	F	F	F	C	F	F	F	C		F
Participants Launch Websites	N	Y	Y	N	Y	N	N	Y	Y	N	/	N
Bookmarks	N	Y	Y	Y	Y	Y	/	Y	Y	Y	/	Y
Hyperlinks available to participants	Y	N	Y	Y	Y	Y	/	Y	Y	Y	/	Y
Links Open In Specific Browser	IE	N	IE	IE	N	N	/	N	N	N	/	N
Webtour/Individual browsing/Combination/Either		W	C	E	I	C	/	Either	C	I	/	C
Application Sharing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bandwidth requirements		32kbps	14kbps-500kbps	512kbps	14.4 kbps - Individualised Bandwidth Management	33.3kbps			56kbps		50kbps or less	75kbps

Interactivity	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Passing Control	Y		Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Breakout Rooms Available	N	Y	Y	Y	Y	Y	Y -Training Centre	N - other classrooms used instead	Y	N	N	Audio
Breakout Room Features - All/Reduced	/	All	All	All	All	All	All	All	All	/	/	/
Participants Pre-assignable to Rooms	/	Y	Y	Y	Y	Y	N	Y	N	/	/	/
Possibleto Move Participants From Room To Room	/	Y	Y	Y	Y	Y	Y	N	Y	/	/	/
Materials Movable From Room To Room	/	Y	Y	Y - Drag & drop	Y	Y	N	N	Y	/	/	/
Recording	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Special Software Required To View	N -.wmv	Y	Y	N -.wmv or .avi	Y	N	Y	LVC	N	N		N - avi
Downloadable	Y	N	Y	Y		Y	Y	N	Y	N		Y
Stop and Restart Capabilities	Y	N	Y	N	Y	Y- gives 2 files	Y	Y	Y	Y	N	N
Number Of Privilege Levels	2	3	2	2	2	3	2	3	2	2	2	3
Functionality Of Facilitator LVC vs Participant LVC	Total	Tiered	Total	Total	Total	Total - P's very limited			Total	Configura ble	Total	Total
Promotion And Demotion Of Participants	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y - P		Y
Content Uploadable Spontaneously During Class	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Live Video	N	Y	Y	Y	B&W/Colour	Y	Y		Y	N	N	Y
Bandwidth/Hardware Requirements For Live Video	/	40kbps	56kbps	30-40 kbps		64.4kbps	30-40kbps		56kbps for receipt	/	/	80 kbps
File Formats Allowed	Powerpoint	Powerpoint, html, flash, pdfs, images	Powerpoint, proprietary whiteboard and MCQ files	Powerpoint, pdfs	Powerpoint, quicktime, flash	Flash, avi, Powerpoint, Word docs, Excel spreadsheets, etc	Powerpoint, Flash	Powerpoint, jpg, flash, flv, mp3, zip	Flash, Powerpoint, graphics	Powerpoin t, MS Office	Powerpoin t, Impress. Gif, jpg, zip	Powerpoint
Animated Content Annotatable	Not supported	Not supported	In Application Share	Not supported	Not supported	Y	Not supported	In Application Share	Y	Y	Not supported	Y
	Number	**%**										
Externally hosted	**7**	**58%**										
Plugins required	**5**	**42%**										
Proprietary	**11**	**92%**										

Appendix E LVC Participant's Questionnaire

Please answer the following questions with reference to your experience as a participant in the LVC class environment. Please reflect on and respond to the questions in terms of your knowledge of e-learning and your experience as a student and a participant of the LVC as a synchronous e-learning technology in its own right.

Please do not compare the LVC to asynchronous e-learning or to the traditional, face-to-face classes with which you are most familiar.

Profile

1. My age is _____.

2. Gender
   Female
   Male

3. I am very experienced in participating in synchronous (same time, different place) e-learning classes.

Strongly Disagree	1	2	3	4	Strongly Agree

4. I have had extensive training in how to participate in synchronous e-learning classes.

Strongly Disagree	1	2	3	4	Strongly Agree

Opinions and attitudes on the facilitation of synchronous e-learning classes in the LVC

The questions in this section are intended to determine **your opinions** on issues related to the **facilitation (i.e. teaching)** of the synchronous classes.

5. It is important for facilitators to have had practice in the use an LVC environment before taking a class.

Strongly Disagree	1	2	3	4	Strongly Agree

6. The LVC software helped to engage participants in such a way that disengagement from the class/destructive behaviours were avoided.

Strongly Disagree	1	2	3	4	Strongly Agree

7. The facilitator connected positively with the participants.

Strongly Disagree	1	2	3	4	Strongly Agree

8. The facilitator was able to devote sufficient attention to all participants.

Strongly Disagree	1	2	3	4	Strongly Agree

9. The use of a second facilitator or a moderator could be beneficial or offer useful possibilities in the LVC environment.

Strongly Disagree	1	2	3	4	Strongly Agree

10. The facilitator felt enthusiastic about the opportunity to facilitate a class using the LVC technology.

Strongly Disagree	1	2	3	4	Strongly Agree

Participant's opinions and attitudes about their LVC class

The questions in this section are intended to determine **your opinions** about your own, **personal experiences**.

11. LVC class participation requires particular skills.

Strongly Disagree	1	2	3	4	Strongly Agree

12. It is desirable for participants to have had practice in the use of LVC software and in the LVC environment before taking a class.

Strongly Disagree	1	2	3	4	Strongly Agree

13. I found the LVC environment intimidating.

Strongly Disagree	1	2	3	4	Strongly Agree

14. I felt comfortable in the LVC environment.

Strongly Disagree	1	2	3	4	Strongly Agree

15. I felt confident using the LVC software within a short period of time.

Strongly Disagree	1	2	3	4	Strongly Agree

16. I found the LVC environment to be a distractor within the educational environment – in other words, the LVC environment distracted me from learning.

Strongly Disagree	1	2	3	4	Strongly Agree

17. Having previously met one another face-to-face contributed to a positive dynamic within the LVC class during the class.

Strongly Disagree	1	2	3	4	Strongly Agree

18. To whom do you think pre-class face-to-face meetings are most beneficial?
    The facilitator
    The participants
    Both benefit equally
    Neither benefits

19. Participants connected and interacted with one another in a positive manner.

Strongly Disagree	1	2	3	4	Strongly Agree

20. I believe that variations in participants' individual learning contexts and/or backgrounds would be highlighted by the LVC technology.

Strongly Disagree	1	2	3	4	Strongly Agree

21. Before the LVC class began I felt enthusiastic about the opportunity to participate in a class using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

22. After the LVC class ended I felt pleased and positive about the experience of participating in a class using this technology.

Strongly Disagree	1	2	3	4	Strongly Agree

23. I would choose to take part in another class using the LVC.

Strongly Disagree	1	2	3	4	Strongly Agree

24. The LVC made some participants inequitably (unfairly) anonymous in comparison to others.

Strongly Disagree	1	2	3	4	Strongly Agree

25. Participants maintained the same pace of learning.

Strongly Disagree	1	2	3	4	Strongly Agree

26. To what extent do you agree with the following statements? **Please tick the box to the right of each scale if you feel that LVC technology had a significant impact on your rating**.

a) I felt involved in the class

Strongly Disagree	1	2	3	4	Strongly Agree	LVC a determinant? ☐

b) I was able to concentrate easily on the class

Strongly Disagree	1	2	3	4	Strongly Agree	LVC a determinant? ☐

c) I found the class interactive

Strongly Disagree	1	2	3	4	Strongly Agree	LVC a determinant? ☐

d) I felt suitably in control of my own learning process

Strongly Disagree	1	2	3	4	Strongly Agree	LVC a determinant? ☐

e) I felt distanced from the facilitator

Strongly Disagree	1	2	3	4	Strongly Agree	LVC a determinant? ☐

f) I felt distanced from the other participants and disengaged the class.

Strongly Disagree	1	2	3	4	Strongly Agree	☐

Technical issues

The questions in this section are intended to determine **your opinions** about and experiences with **technical aspects** of LVC.

27. Learning materials used in the class (e.g. slides, what was written on the whiteboard, etc) were clear and readable.

Strongly Disagree	1	2	3	4	Strongly Agree

28. The quality and clarity of the video was high.

Strongly Disagree	1	2	3	4	Strongly Agree

29. The quality and clarity of the audio was high.

Strongly Disagree	1	2	3	4	Strongly Agree

30. Audio and video were well synchronised.

Strongly Disagree	1	2	3	4	Strongly Agree

31. The ability to see the facilitator, the learning materials (e.g. slides) and the participant using the participant camera (if and when appropriate) clearly, all at the same time was very valuable.

Strongly Disagree	1	2	3	4	Strongly Agree

32. Rate the three elements of a LVC class listed below to indicate how important you consider each one.

    The facilitator (voice and video when appropriate)

Unimportant	1	2	3	4	Important

    The participants (voice and video when appropriate)

Unimportant	1	2	3	4	Important

    The learning materials (e.g. slides)

Unimportant	1	2	3	4	Important

33. The camera allowed me to make eye contact with the other participants/the facilitator (if and when appropriate) over the LVC link.

Strongly Disagree	1	2	3	4	Strongly Agree

Was this important, and if so, why?

34. The camera allowed me to read the facial expressions of other participants/the facilitator (if and when appropriate) over the LVC link.

Strongly Disagree	1	2	3	4	Strongly Agree

Was this important, and if so, why?

35. The camera allowed me to read the body language of other participants/the facilitator (if and when appropriate) over the LVC link.

Strongly Disagree	1	2	3	4	Strongly Agree

Was this important, and if so, why?

36. The LVC technology was straightforward to use.

Strongly Disagree	1	2	3	4	Strongly Agree

37. The LVC technology was completely reliable during the class.

Strongly Disagree	1	2	3	4	Strongly Agree

38. The LVC allowed all participants to participate in the class without difficulty.

Strongly Disagree	1	2	3	4	Strongly Agree

39. The LVC technology supports interactive and engaging synchronous e-learning over the web.

Strongly Disagree	1	2	3	4	Strongly Agree

40. Features of the technology can facilitate and support different styles of learning (see appendix if this is confusing to you).

Strongly Disagree	1	2	3	4	Strongly Agree

General Impression and Comments

41. Would you recommend the LVC technology to others?

Yes	No

42. Would you recommend for specific teaching styles or learning situations?

Yes	No

If yes, which situations would be appropriate?

43. List up to three things not already covered by the questionnaire that you feel are either positive or negative about the LVC technology as a vehicle for learning-delivery.

Positive:
Negative:

44. Is there anything else that you consider important about your experiences or observations that has not been addressed by this questionnaire? If so, please tell us about it here.

Appendix to LVC Participant's Questionnaire - Learning Styles

The seven commonly identified learning styles are :

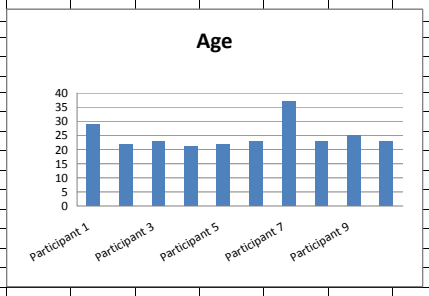
1. Visual (spatial) - those who prefer to learn using pictures, images, and spatial understanding.
2. Aural (auditory-musical) - those who prefer to learn using sound and music.
3. Verbal (linguistic) - those who prefer to learn using words, both in speech and writing.
4. Physical (kinesthetic) - those who prefer to learn using your body, hands and sense of touch.
5. Logical (mathematical) - those who prefer to learn using logic, reasoning and systems.
6. Social (interpersonal) - those who prefer to learn to learn in groups or with other people.
7. Solitary (intrapersonal) - those who prefer to learn to work a

Appendix F - LVC Questionnaire Results

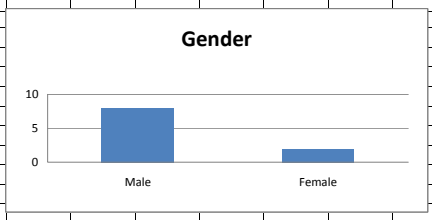
Profile

How old are you?

	Age
Participant 1	29
Participant 2	22
Participant 3	23
Participant 4	21
Participant 5	22
Participant 6	23
Participant 7	37
Participant 8	23
Participant 9	25
Participant 10	23

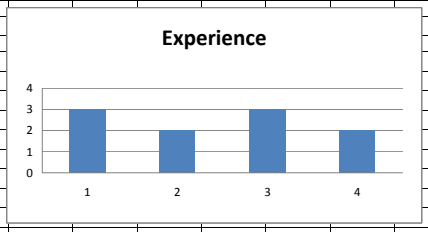


	Gender	Male	Female
Participant 1			1
Participant 2		1	
Participant 3		1	
Participant 4		1	
Participant 5		1	
Participant 6		1	
Participant 7		1	
Participant 8		1	
Participant 9		1	
Participant 10			1
		8	2



I am very experienced in participating in synchronous e-learning courses

	Experience	1	2	3	4
Participant 1		1			
Participant 2				1	
Participant 3					1
Participant 4					1
Participant 5		1			
Participant 6			1		
Participant 7				1	
Participant 8				1	
Participant 9		1			
Participant 10			1		
		3	2	3	2



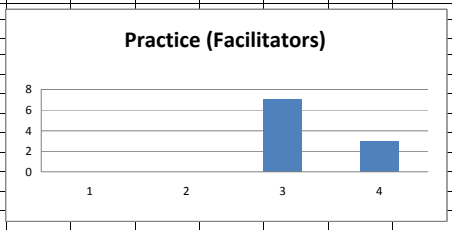
I have had extensive training in how to participate in synchronous e-learning courses

	Training	1	2	3	4
Participant 1			1		
Participant 2			1		
Participant 3				1	
Participant 4			1		
Participant 5		1			
Participant 6			1		
Participant 7				1	
Participant 8			1		
Participant 9		1			
Participant 10				1	
		2	5	3	0

Opinions and attitudes on the facilitation of synchronous e-learning classes in the LVC

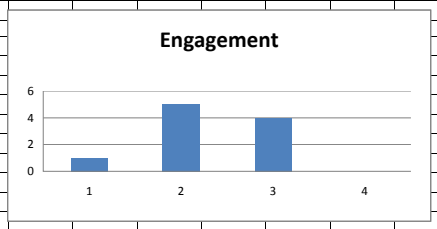
It is important for facilitators to have practice in the use of an LVC environment

	Practice - F	1	2	3	4
Participant 1					1
Participant 2					1
Participant 3					1
Participant 4					1
Participant 5					1
Participant 6					1
Participant 7					1
Participant 8					1
Participant 9					1
Participant 10					1
		0	0	7	3



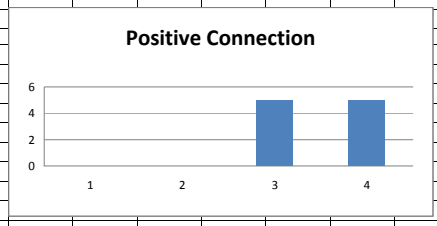
The LVC software helped to engage participants in such a way that disengagement from the class/destructive behaviours were avoided

6	Engagement	1	2	3	4
	Participant 1		1		
	Participant 2			1	
	Participant 3		1		
	Participant 4			1	
	Participant 5			1	
	Participant 6		1		
	Participant 7			1	
	Participant 8		1		
	Participant 9		1		
	Participant 10	1			
		1	5	4	0



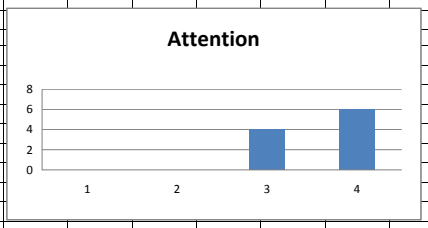
The facilitator connected positively with the participants

7	Positive Connection	1	2	3	4
	Participant 1			1	
	Participant 2				1
	Participant 3				1
	Participant 4			1	
	Participant 5			1	
	Participant 6				1
	Participant 7				1
	Participant 8			1	
	Participant 9				1
	Participant 10			1	
		0	0	5	5



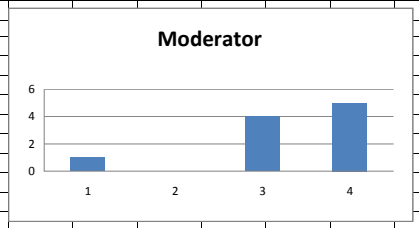
The facilitator was able to devote sufficient attention to all participants

8	Attention	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3				1
	Participant 4			1	
	Participant 5			1	
	Participant 6				1
	Participant 7			1	
	Participant 8			1	
	Participant 9				1
	Participant 10				1
		0	0	4	6



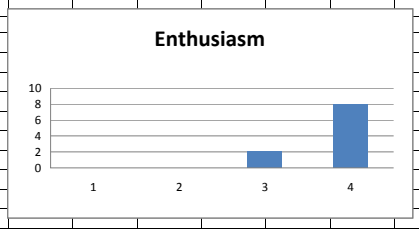
The use of a second facilitator or moderator could be beneficial or offer useful possibilities in the LVC environment

9	Moderator	1	2	3	4
	Participant 1				1
	Participant 2			1	
	Participant 3				1
	Participant 4				1
	Participant 5			1	
	Participant 6				1
	Participant 7	1			
	Participant 8			1	
	Participant 9				1
	Participant 10			1	
		1	0	4	5



The facilitator felt enthusiastic about the opportunity to facilitate a class using the LVC technology

10	Enthusiam	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3				1
	Participant 4			1	
	Participant 5				1
	Participant 6				1
	Participant 7				1
	Participant 8			1	
	Participant 9				1
	Participant 10				1
		0	0	2	8

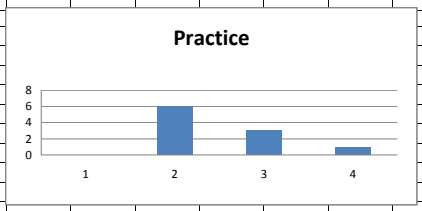


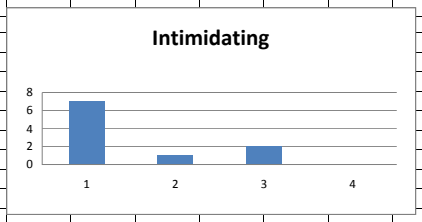
Participant's opinions and attitudes about their LVC class

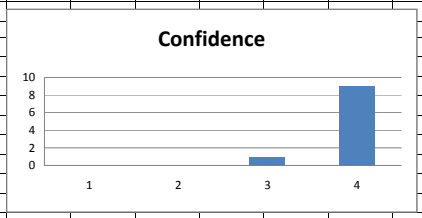
LVC class participation requires particular skills

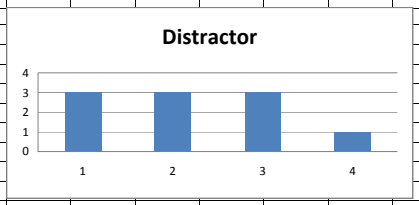
11	Skills	1	2	3	4
	Participant 1		1		
	Participant 2		1		
	Participant 3				1
	Participant 4		1		
	Participant 5		1		
	Participant 6			1	
	Participant 7			1	
	Participant 8		1		
	Participant 9			1	
	Participant 10		1		
		0	6	3	1

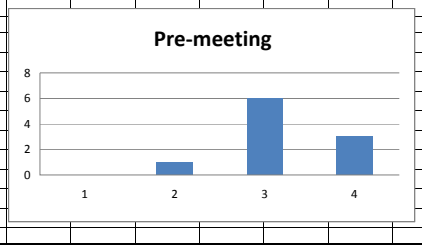
	It is desirable for participants to have had practice in the use of LVC software and in the LVC environment before taking a class					
12	**Practice**	1	2	3	4	
	Participant 1		1			
	Participant 2		1			
	Participant 3				1	
	Participant 4		1			
	Participant 5		1			
	Participant 6			1		
	Participant 7			1		
	Participant 8		1			
	Participant 9			1		
	Participant 10		1			
		0	6	3	1	
	I found the the LVC environment intimidating					
13	**Intimidating**	1	2	3	4	
	Participant 1			1		
	Participant 2			1		
	Participant 3	1				
	Participant 4	1				
	Participant 5	1				
	Participant 6	1				
	Participant 7	1				
	Participant 8		1			
	Participant 9	1				
	Participant 10	1				
		7	1	2	0	
	I felt comfortable in the LVC environment					
14	**Comfort**	1	2	3	4	
	Participant 1		1			
	Participant 2				1	
	Participant 3				1	
	Participant 4				1	
	Participant 5				1	
	Participant 6				1	
	Participant 7				1	
	Participant 8			1		
	Participant 9				1	
	Participant 10				1	
		0	1	1	8	
	I felt confident using the LVC software within a short period of time					
15	**Confidence**	1	2	3	4	
	Participant 1			1		
	Participant 2				1	
	Participant 3				1	
	Participant 4				1	
	Participant 5				1	
	Participant 6				1	
	Participant 7				1	
	Participant 8				1	
	Participant 9				1	
	Participant 10				1	
		0	0	1	9	
	I found the the LVC environment to be a distractor					
16	**Distractor**	1	2	3	4	
	Participant 1			1		
	Participant 2		1			
	Participant 3	1				
	Participant 4		1			
	Participant 5			1		
	Participant 6	1				
	Participant 7			1		
	Participant 8	1				
	Participant 9		1			
	Participant 10				1	
		3	3	3	1	
	Having previously met one another face-to-face contributed to a positive dynamic within the LVC class during the class					
17	**Pre-meeting**	1	2	3	4	
	Participant 1				1	
	Participant 2			1		
	Participant 3			1		
	Participant 4			1		
	Participant 5				1	
	Participant 6			1		
	Participant 7				1	
	Participant 8		1			
	Participant 9			1		
	Participant 10			1		
		0	1	6	3	



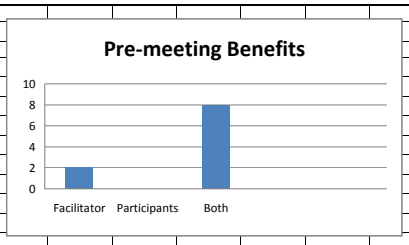




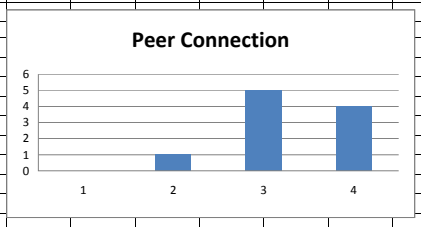




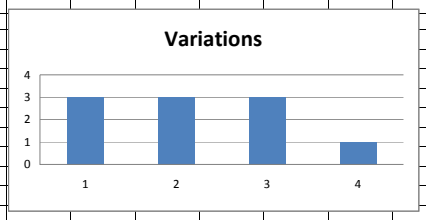
	To whom do you think pre-class face-to-face meetings are most beneficial?				
18	**Pre-meeting Benefits**	Facilitator	Participants	Both	
	Participant 1			1	
	Participant 2			1	
	Participant 3			1	
	Participant 4			1	
	Participant 5	1			
	Participant 6			1	
	Participant 7			1	
	Participant 8	1			
	Participant 9			1	
	Participant 10			1	
		2	0	8	



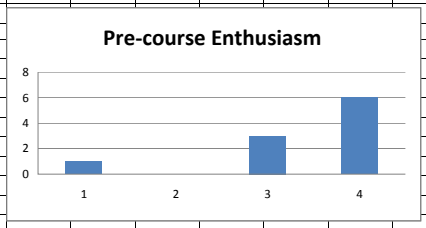
	Participants connected and interacted with one another in a positive manne				
19	**Peer connection**	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3			1	
	Participant 4			1	
	Participant 5			1	
	Participant 6			1	
	Participant 7				1
	Participant 8		1		
	Participant 9			1	
	Participant 10				1
		0	1	5	4



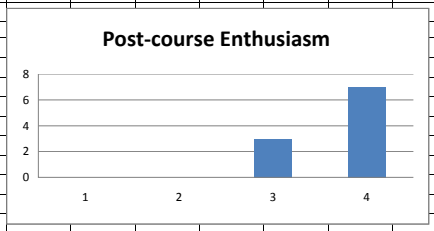
	I believe that variations in participants' individual learning contexts and/or backgrounds would be highlighted by the LVC technology				
20	**Variations**	1	2	3	4
	Participant 1	1			
	Participant 2			1	
	Participant 3	1			
	Participant 4		1		
	Participant 5		1		
	Participant 6			1	
	Participant 7				1
	Participant 8		1		
	Participant 9	1			
	Participant 10			1	
		3	3	3	1



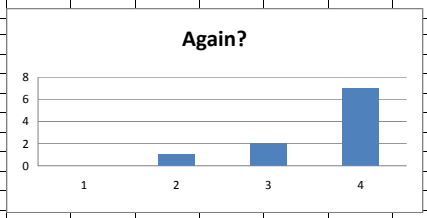
	Pre-class enthusiam for participating in a class using the LVC				
21	**Pre-class enthusiam**	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3				1
	Participant 4	1			
	Participant 5			1	
	Participant 6				1
	Participant 7				1
	Participant 8				1
	Participant 9			1	
	Participant 10			1	
		1	0	3	6



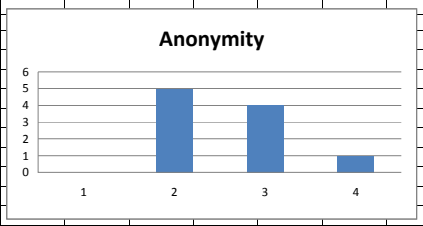
	Post-class enthusiam for participating in a class using the LVC				
22	**Post-class enthusiam**	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3				1
	Participant 4			1	
	Participant 5			1	
	Participant 6				1
	Participant 7				1
	Participant 8				1
	Participant 9			1	
	Participant 10				1
		0	0	3	7

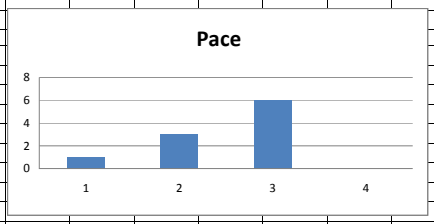


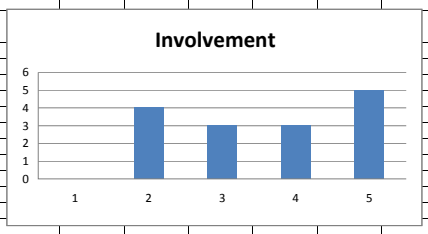
	I would choose to take part in another class or course using the LVC				
23	**Again?**	1	2	3	4
	Participant 1				1
	Participant 2				1
	Participant 3				1
	Participant 4		1		
	Participant 5				1
	Participant 6				1
	Participant 7				1
	Participant 8				1
	Participant 9			1	
	Participant 10			1	
		0	1	2	7

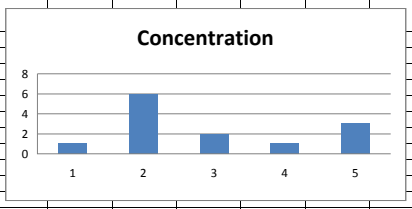


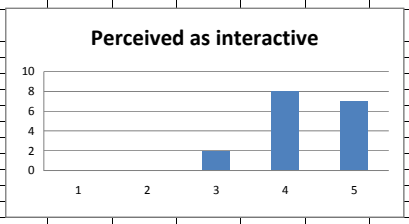
	The LVC made some participants inequitably (unfairly) anonymous in comparison to others						
24	**Anonymity**	1	2	3	4		
	Participant 1		1				
	Participant 2			1			
	Participant 3		1				
	Participant 4			1			
	Participant 5			1			
	Participant 6				1		
	Participant 7			1			
	Participant 8		1				
	Participant 9		1				
	Participant 10		1				
		0	5	4	1		
	Participants maintained the same pace of learning						
25	**Pace**	1	2	3	4		
	Participant 1			1			
	Participant 2			1			
	Participant 3		1				
	Participant 4		1				
	Participant 5			1			
	Participant 6			1			
	Participant 7	1					
	Participant 8			1			
	Participant 9			1			
	Participant 10		1				
		1	3	6	0		
	I felt involved in the clas:						
26-a	**Involvement**	1	2	3	4		the LVC Impacted
	Participant 1				1		
	Participant 2			1			
	Participant 3				1	1	
	Participant 4		1				
	Participant 5		1				
	Participant 6			1			
	Participant 7		1			1	
	Participant 8			1		1	
	Participant 9				1	1	
	Participant 10		1			1	
		0	4	3	3	5	
	I was able to concentrate easily on the class						
26-b	**Concentration**	1	2	3	4		the LVC Impacted
	Participant 1		1				
	Participant 2			1			
	Participant 3				1		
	Participant 4		1				
	Participant 5		1				
	Participant 6		1				
	Participant 7		1			1	
	Participant 8		1				
	Participant 9			1		1	
	Participant 10	1				1	
		1	6	2	1	3	
	I found the class interactive						
26-c	**Perceived as Interactive - L**	1	2	3	4		the LVC Impacted
	Participant 1				1		
	Participant 2				1	1	
	Participant 3				1	1	
	Participant 4			1			
	Participant 5			1			
	Participant 6				1	1	
	Participant 7				1	1	
	Participant 8				1	1	
	Participant 9				1	1	
	Participant 10				1	1	
		0	0	2	8	7	
	I felt in control of my own learning process						
26-d	**Control**	1	2	3	4		the LVC Impacted
	Participant 1				1		
	Participant 2			1		1	
	Participant 3				1		
	Participant 4			1			
	Participant 5		1				
	Participant 6			1		1	
	Participant 7		1			1	
	Participant 8			1		1	
	Participant 9		1				
	Participant 10		1				
		0	4	4	2	4	

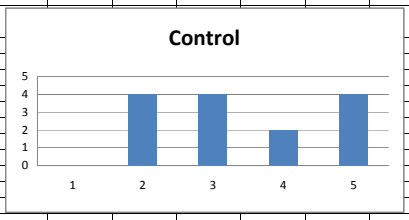






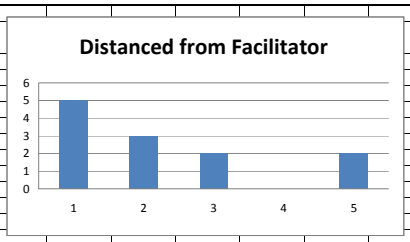






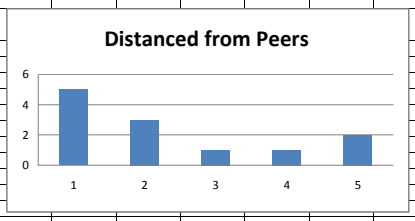
I felt distanced from the facilitator

26-e	Distanced from Facilitator	1	2	3	4	the LVC Impacted
	Participant 1	1				
	Participant 2		1			
	Participant 3	1				
	Participant 4		1			
	Participant 5			1		
	Participant 6			1		1
	Participant 7	1				
	Participant 8		1			
	Participant 9	1				1
	Participant 10	1				
		5	3	2	0	2



I felt distanced from the other participants and disengaged from the class

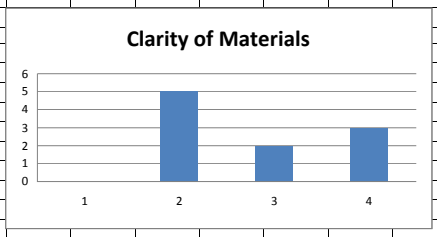
26-f	Distanced from Peers	1	2	3	4	the LVC Impacted
	Participant 1		1			
	Participant 2		1			
	Participant 3	1				
	Participant 4		1			
	Participant 5				1	
	Participant 6			1		
	Participant 7	1				
	Participant 8	1				1
	Participant 9	1				1
	Participant 10	1				
		5	3	1	1	2



Technical issues

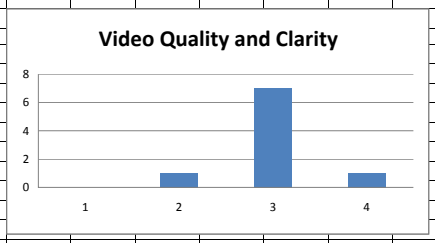
Learning materials used in the course (e.g. slides) were clear and readable

27	Clarity of Materials	1	2	3	4
	Participant 1		1		
	Participant 2		1		
	Participant 3				1
	Participant 4			1	
	Participant 5		1		
	Participant 6				1
	Participant 7		1		
	Participant 8		1		
	Participant 9				1
	Participant 10			1	
		0	5	2	3



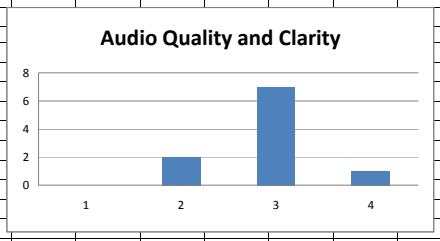
The quality and clarity of the video was high

28	Video Q & C	1	2	3	4
	Participant 1			1	
	Participant 2			1	
	Participant 3			1	
	Participant 4			1	
	Participant 5			1	
	Participant 6			1	
	Participant 7				
	Participant 8		1		
	Participant 9				1
	Participant 10			1	
		0	1	7	1



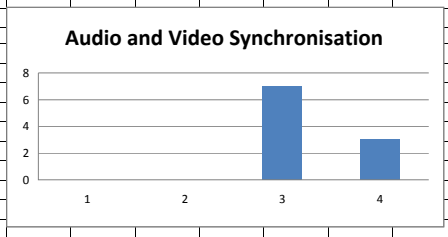
The quality and clarity of the audio was high

29	Audio Q & C	1	2	3	4
	Participant 1			1	
	Participant 2			1	
	Participant 3				1
	Participant 4		1		
	Participant 5			1	
	Participant 6			1	
	Participant 7			1	
	Participant 8			1	
	Participant 9		1		
	Participant 10			1	
		0	2	7	1



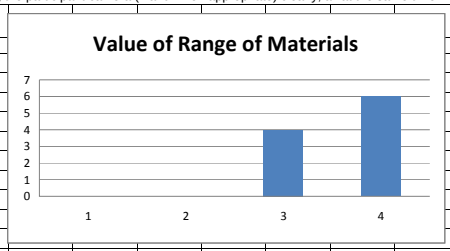
Audio and video were well synchronised

30	Synchronisation	1	2	3	4
	Participant 1			1	
	Participant 2			1	
	Participant 3				1
	Participant 4			1	
	Participant 5			1	
	Participant 6			1	
	Participant 7				1
	Participant 8			1	
	Participant 9			1	
	Participant 10				1
		0	0	7	3



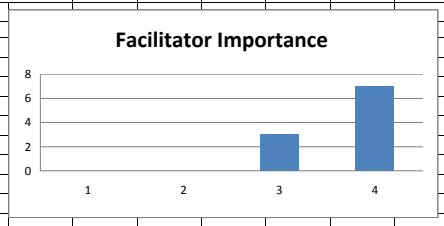
The ability to see the facilitator, the learning materials (e.g. slides) and the participant using the participant camera (if and when appropriate) clearly, all at the same time was very valuable

31	Value of range of Materials	1	2	3	4
	Participant 1				1
	Participant 2			1	
	Participant 3				1
	Participant 4			1	
	Participant 5			1	
	Participant 6			1	
	Participant 7				1
	Participant 8				1
	Participant 9				1
	Participant 10				1
		0	0	4	6



The importance of the facilitator (voice and video when appropriate) as an element of the class

32-a	Facilitator importance	1	2	3	4
	Participant 1				1
	Participant 2			1	
	Participant 3				1
	Participant 4			1	
	Participant 5				1
	Participant 6				1
	Participant 7				1
	Participant 8				1
	Participant 9				1
	Participant 10			1	
		0	0	3	7

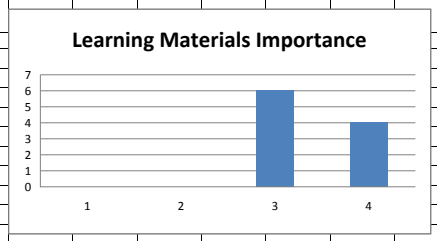


The importance of the participants (voice and video when appropriate) as an element of the class

32-b	Participant importance	1	2	3	4
	Participant 1		1		
	Participant 2				1
	Participant 3			1	
	Participant 4			1	
	Participant 5				1
	Participant 6		1		
	Participant 7		1		
	Participant 8		1		
	Participant 9			1	
	Participant 10			1	
		0	4	4	2

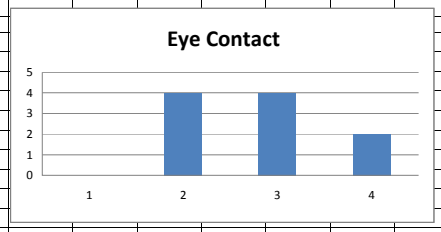
The importance of the learning materials as an element of the class

32-c	Learning materials importance	1	2	3	4
	Participant 1				1
	Participant 2			1	
	Participant 3				1
	Participant 4			1	
	Participant 5				1
	Participant 6			1	
	Participant 7			1	
	Participant 8			1	
	Participant 9				1
	Participant 10			1	
		0	0	6	4



The camera allowed eye contact with the other learners/the facilitator

33	Camera - Eye Contact	1	2	3	4
	Participant 1		1		
	Participant 2			1	
	Participant 3		1		
	Participant 4			1	
	Participant 5		1		
	Participant 6			1	
	Participant 7		1		
	Participant 8			1	
	Participant 9				1
	Participant 10				1
		0	4	4	2



Is this important, and if so, why?

Participant 2 – By making eye contact you could see that the participant was interested and paying attention

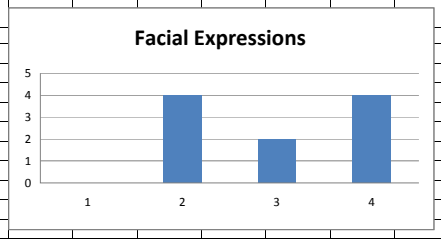
Participant 4 – You engage with the class

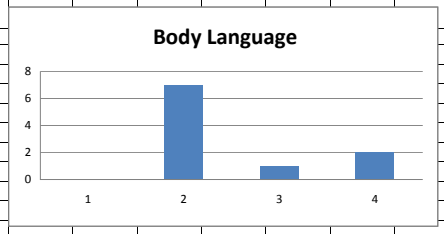
Participant 6 – In a normal classroom scenario it is not possible

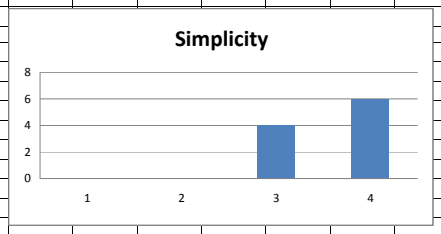
Participant 9 - Yes- being able to see the lecturer speaking live helps comprehension and emphasis in a big way

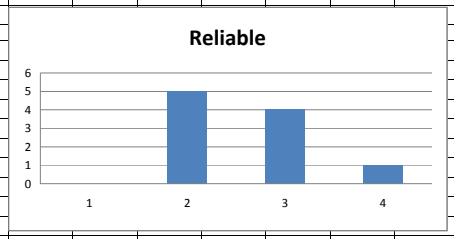
Participant 10 – It helped me feel connected to the rest of the class

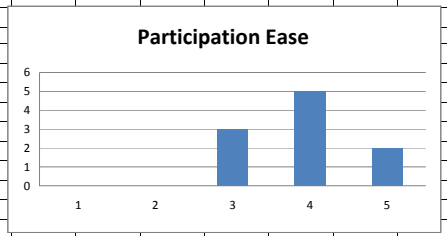
	The camera allowed me to read the facial expressions of the other learners/the facilitator					
34	**Camera - Facial Expressions**	1	2	3	4	
	Participant 1				1	
	Participant 2				1	
	Participant 3		1			
	Participant 4			1		
	Participant 5		1			
	Participant 6				1	
	Participant 7		1			
	Participant 8			1		
	Participant 9				1	
	Participant 10		1			
		0	4	2	4	
	Is this important, and if so, why?					
	Participant 2 – [facial expressions] gave an indication as to whether the participant was concentrating and aware of what was going on/taking place					
	Participant 4 – Makes the experience personal					
	Participant 6 – able to see exactly how involved/enthusiastic the facilitator was about the topic					
	Participant 9 – same as 33					
	Participant 10 – I did not really find this important					
	The camera allowed me to read the body language of the other learners/the facilitator					
35	**Camera - Body Language**	1	2	3	4	
	Participant 1				1	
	Participant 2		1			
	Participant 3		1			
	Participant 4		1			
	Participant 5		1			
	Participant 6			1		
	Participant 7		1			
	Participant 8		1			
	Participant 9				1	
	Participant 10		1			
		0	7	1	2	
	Is this important, and if so, why?					
	Participant 2 – mostly could just see the head					
	Participant 6 – it helps me keep focussed on the topic and on the facilitator					
	Participant 9 – same as 33					
	The LVC technology was straightforward to use					
36	**Simplicity**	1	2	3	4	
	Participant 1			1		
	Participant 2				1	
	Participant 3				1	
	Participant 4			1		
	Participant 5				1	
	Participant 6				1	
	Participant 7				1	
	Participant 8			1		
	Participant 9				1	
	Participant 10			1		
		0	0	4	6	
	The LVC system was reliable during the class					
37	**Reliable**	1	2	3	4	
	Participant 1			1		
	Participant 2		1			
	Participant 3		1			
	Participant 4			1		
	Participant 5		1			
	Participant 6			1		
	Participant 7				1	
	Participant 8		1			
	Participant 9		1			
	Participant 10			1		
		0	5	4	1	
	The LVC allowed all participants to participate in the class without difficulty					
38	**Participation Ease**	1	2	3	4	
	Participant 1				1	
	Participant 2		1			
	Participant 3		1			
	Participant 4			1		
	Participant 5				1	
	Participant 6			1		
	Participant 7			1		
	Participant 8			1		
	Participant 9		1			
	Participant 10			1		
		0	3	5	2	



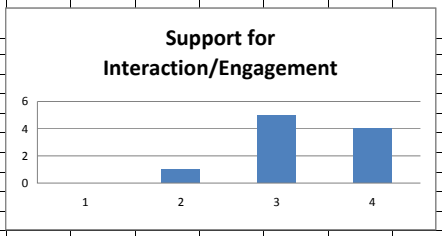




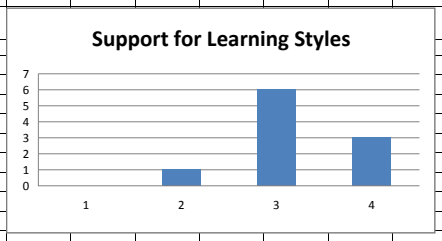




	The LVC technology supports interactive and engaging synchronous e-learning over the web					
39	**Support for interaction/engagement**	1	2	3	4	
	Participant 1				1	
	Participant 2				1	
	Participant 3			1		
	Participant 4			1		
	Participant 5				1	
	Participant 6			1		
	Participant 7				1	
	Participant 8			1		
	Participant 9		1			
	Participant 10			1		
		0	1	5	4	

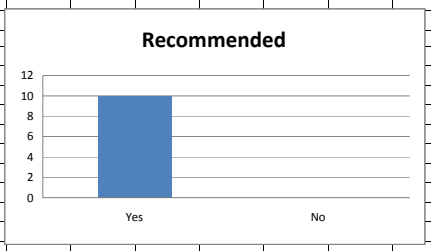


	Features of the technology can facilitate and support different styles of learning					
40	**Support for variety of learning styles**	1	2	3	4	
	Participant 1			1		
	Participant 2				1	
	Participant 3				1	
	Participant 4			1		
	Participant 5				1	
	Participant 6			1		
	Participant 7			1		
	Participant 8			1		
	Participant 9			1		
	Participant 10		1			
		0	1	6	3	

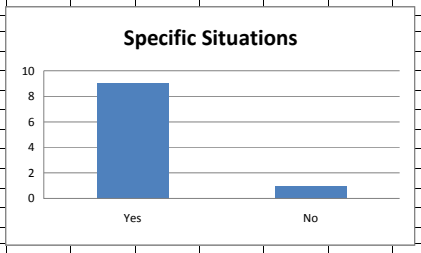


General Impression and Comments

	Would you recommend the LVC technology to others?					
41	**Recommended**	Yes	No			
	Participant 1	1				
	Participant 2	1				
	Participant 3	1				
	Participant 4	1				
	Participant 5	1				
	Participant 6	1				
	Participant 7	1				
	Participant 8	1				
	Participant 9	1				
	Participant 10	1				
		10	0			



	Would you recommend the LVC for specific teaching styles or learning situations?					
42	**Specific situations**	Yes	No			
	Participant 1	1				
	Participant 2	1				
	Participant 3	1				
	Participant 4		1			
	Participant 5	1				
	Participant 6	1				
	Participant 7	1				
	Participant 8	1				
	Participant 9	1				
	Participant 10	1				
		9	1			



Participant 1 - I wouldn't use this medium for learners with certain learning difficulties e.g. dyslexia (unless mic was working)

Participant 2 – There should preferably be 1 person per workstation, webcam, mic, etc. No background noises.

Participant 3 – Over long distances or in situations where one wants to avoid the traditional trend of having one person who imparts all the knowledge

Participant 5 – Distance learning /discussions. Classes where non-practical subjects.

Participant 6 – distance learning

Participant 7 – Anything that keeps the students involved

Participant 8 – Easily quantifiable concepts, as there is a lack of empathy that is required in order to explain various "touchy-feely" concepts

Participant 9 – Distance learning/discussion groups/brainstorming sessions

Participant 10 – I would suggest it only be used once all participants have met face to face

Is there anything further you would like to say, either positive or negative, about the LVC technology as a vehicle for learning-delivery? Is there anything else that you consider important about your experiences or observations that has not been addressed by this questionnaire? If so, please tell us about it here.

43	Comments:	Positive	Negative	Other				
	Participant 2	Seeing the participants, especially when they are commenting, and being able to change the colour of the text.	Full use of screen space ie slides could have been bigger	The length of lesson should be no longer than 40 min, found myself getting slightly distracted & started to lose interest. [Also see email – usefulness of being able to Google during lesson].				
	Participant 3	Integration with slides was great	A person without technical knowledge would have found it hard to solve the various problems					
	Participant 4		If no webcam felt distance					
	Participant 5	Generally very interesting- think will see more of LVC prominence in the future as alearning tool						
	Participant 6	Good video and audio aspects. It works very well and effective	General design aspects of screen. Use of buttons, loggin in, colours, etc					
	Participant 7	Novel, hope this does not wear off	Too easy to be distracted	Allow the participant listbox to grow				
	Participant 8	The use of multiple mediums for teaching, as well as multiple channels of conversation, allows for various means of communication, especially when a learner is not comfortable with one particular medium	A lack of "policing" can lead to users who are not acting responsibly distracting the class					
	Participant 9		Need moderation on typed chat. Can presenter see who she wants to see?					
	Participant 10	Enables distance learning	Very difficult to engage. the forum is distracting	It might help to allow the facilitator to turn off the forum during the class				