

# **An Analysis of User Requirements for Virtual Classroom/Collaboration Software**

**(Project: P12\_016)**

## **Executive Summary**

**Dr. Jin Tan September 2012**

### **Subject of matter**

This report focuses on an analysis of the user requirements for virtual classroom/collaboration software (VCCS) in learning and teaching. It collates and priorities existing users requirements, reviews tools in the market, and recommends good tools that fit these requirements.

### **Methods of analysis**

Based on the feedback from the VLE group meetings, this project has undertaken an online questionnaire and one-to-one interviews to gather existing user requirements. In the process of evaluating VCCS tools, it adopted literature review, reviewing application websites, and application testing. It also invited a participant to review the recommended tools.

### **Data collection**

Eleven out of twenty-three schools expressed their interest in the project. 15 volunteers participated in an online survey and this was then followed by a one-to-one interview. 6 out of 15 participants have experience of using VCCS, and the other 9 participants stated that they are planning to use a VCCS tool in Learning and Teaching activities.

The review of available VCCS tools in the market was through four groups:

1) tools that have been mentioned by the VLE group; 2) tools recommended by the VLE or e-learning professional interest groups and organisations; 3) tools recommended in research papers and academic journal articles in education settings, and 4) reliable awards for learning technology products.

## **Findings**

The data showed that the participants have a positive view about the use of VCCS. There are three distinct requirements particularly in relation to the use of the VCCS:

### 1) Supporting online training and tutoring (the most urgent requirement)

For the use of online training and tutoring, features such as supporting interaction and a variety of ways to engage users, recording, chat, video/audio, screen/application sharing are crucial. This group of users are from libraries, the lifelong learning centre, and schools that run e-learning courses. They normally need to support small groups of distance learners. They expect a practical VCCS solution as soon as possible.

### 2) Supporting online lecture presentations (fairly urgent requirement)

For the use of online lecture presentations, features such as supporting a large number of attendees connected synchronously, recording, playing high-quality presentations are essential. This group of users are from schools that run e-learning courses and that deliver lectures to a large group of students. In particular, the schools run e-learning course to distance students need a better VCCS solution urgently.

### 3) Supporting virtual meetings (not urgent)

For the use of virtual meetings, features such as supporting file transferring, recording, host meetings, chat, video/audio, screen sharing are important. Almost all participants mentioned that the VCCS could support anyone, anywhere to instantly share and communicate. This use is not as urgent as the above two required uses.

In addition to the above, there are three fundamental requirements at the pedagogic level:

- 4) to enhance students learning opportunities,
- 5) to support flexible teaching approaches, and
- 6) to support subjects and specific needs users related to Learning and Teaching.

These three requirements are intrinsically linked in relation to the main uses of the VCCS. In a specific Learning and Teaching activity, participants expected the use of the VCCS to "enhance the students learning opportunities", for example,

- through the features allowing students to attend a session from different locations and/or time zones,
- to customise the screen size/font/colour,
- chat,
- video/audio,
- use whiteboard,
- play quizzes, and
- access by mobile devices.

They also expected that the VCCS provide features to support flexible teaching approaches, such as

- allowing educators to invite external people into a session,
- having different levels of controls,
- easily managing online sessions,
- tracking and assessing students' learning outcomes, and
- easily working with the existing virtual learning system.

Regarding specific subject or a specific learner's needs, they expected the VCCS support an extensible architecture that allows the addition of new tools to meet these specific requirements, for example, allowing users to key in complex mathematics symbols or allowing learners with dyslexia to listen to an audio recording of a session.

By reviewing available tools in the market, it was found that three free VCCS applications (AnyMeeting, TeamViewer, Wiggi) and five commercial applications (Adobe Connect, Blackboard Collaborate, Microsoft Lync, omNovia, WizIQ) meet most user requirements. Examples of these requirements were easy to use, runs on all supported OS and web browsers, reliable service and flexible features.

However, each application has its strengths and weaknesses and as such is unable to meet all functionalities required by participants.

**A) To support online training and tutoring,** all eight applications have "most needed" features, although each lacks of some features. For example,

- AnyMeeting does not allow attendees to upload/download files and does not have breakout rooms.
- TeamViewer does not have breakout rooms, polling, quizzes, and action icons (e.g., hands-up) to support interaction.
- Wiggi has a problem of recording/playing back in the current free version.

Among the commercial applications,

- omNovia does not support Mac users.
- WizIQ does not have quizzes and application sharing.
- Adobe Connect is unable to export polling results and not allow attendees to resize video.
- Microsoft Lync does not support breakout rooms.
- Blackboard Collaborate does not allow attendees to customise font colour, but its features as a whole are slightly better than those features in Microsoft Lync.

**B) To support online lecture presentations,** AnyMeeting is the only free application that supports a large group of attendees (up to 200 attendees). As mentioned above, considering the lack of useful features in omNovia, WizIQ, and Adobe Connect, both Blackboard

Collaborate and Microsoft Lync meet more requirements. Blackboard Collaborate supports additional tools (e.g., complex mathematics symbols) and more types of multimedia files than Microsoft Lync.

**C) To support virtual meetings**, as a free tool, TeamViewer provides all key features the users required. Wiggio is good at supporting work in groups and collaboration. For the commercial tools, Adobe Connect, Blackboard Collaborate and Microsoft Lync all satisfy the user current requirements.

**D) In accordance with pedagogical support, to provide flexible learning opportunities and teaching approaches**, AnyMeeting is better than TeamViewer and Wiggio on the aspects of supporting web tour, polling, recording and tracking students' learning outcomes. However, if the user is trying to use iPad/iPhone, TeamViewer as a whole service provides more useful features than Wiggio. No need to mention again, omNovia and WizIQ are not as good as the other three commercial applications. Adobe Connect is not as good as Blackboard Collaborate because it lacks of some flexible features such as allowing attendees to customise chat font type and video size, and allowing the user to export polling results.

Reviewing the application as a complete service, both Blackboard Collaborate and Microsoft Lync provide many flexible and useful features. However, Microsoft Lync is not as good as Blackboard Collaborate in its component tools such breakout rooms, tracking reports, assessing students' learning outcomes, supporting additional tools for specific needs learner and subjects, supporting multimedia file types, and integrating with the current LMS. Compared to Blackboard Collaborate, Microsoft Lync is a proper option for general collaborative requirements within an organisation, but is not the best software option for specifically supporting Learning and Teaching activities.

## **Conclusion**

It is apparent that no single application meets all user requirements. One application may be more suitable than the other for one or two particular requirements of use in the school.

Based on the analysis, recommendations are as follows:

- In the short term, the schools that urgently need the VCCS (such as supporting tutorials or online trainings for a small group of students) should adopt a free application such as AnyMeeting until a centrally supported solution can be put in place.
- At present, for the users who want to use the VCCS to run virtual meetings or support communication and collaboration, TeamViewer is a good choice and Wiggio satisfies the users who particularly need the VCCS for supporting work in groups.
- During the period of the project, the conclusion of the email review resulted in the decision to implement Microsoft 365, one component of which is Microsoft Lync. Therefore, as it is likely that Microsoft Lync will be available to the university in the first quarter of 2013 and should be promoted for use in Learning and Teaching. This

will benefit the users who want to apply the VCCS to support online training/tutoring in the short term.

- In the short term (before the first quarter of 2013), for the schools that run e-learning courses for distance students (especially a large group of learners) or want to apply the VCCS to support lecture presentations, they may use AnyMeeting to support Learning and Teaching activities. When Microsoft Lync is available, they should apply it and evaluate its features to meet their requirements.
- For the schools that have used one of the VCCS (e.g., Blackboard Collaborate in use by the Department of Dermatology and AccessGrid by the School of Mathematics), they may continue using the existing application. It is recommended that they share their experience of using the VCCS and examples of good practice. When Microsoft Lync is available, these schools may wish to compare it with their current VCCS system and evaluate if it is good enough to replace their current application.
- Where there is a specific requirement to support specific subjects or specific needs of learners and providing a flexible learning environment, Blackboard Collaborate clearly meets more user requirements than Microsoft Lync. Following rollout of Microsoft Lync as an interim solution to the University, how it is meeting specific Learning and Teaching requirements should be reviewed in comparison with Blackboard Collaborate. Should any Schools purchase Blackboard Collaborate in the short term then their experience should be closely monitored to provide a comparison with the Microsoft Lync users experiences.

It is hoped that the report provides detailed information for learning technology support staff to better understand the user requirements for the VCCS and to provide a sound in the support strategic decisions where it pertains to these technologies.

### **Limitations of the report**

There are some limitations in the project may affect the analysis. Firstly, the analysis is based specifically on the information from the participating volunteers. It may not cover all requirements, but it is hoped cover the major and urgent requirements at present.

Secondly, it had a small number of participants and the data was opinion-related, therefore the data from the questionnaire mostly cannot be used as statistical evidence. The project manager tried to understand the matter by interpreting the qualitative data from the interviews and evaluating tools with as little bias as possible.

Lastly, the comparison of the VCCS tools is based on key required features, it is not a thorough product test (e.g., a large number of attendees online and mobile devices were not tested). According to a specific use, it still needs the user to review the features in more depth (e.g., mobile accessing, multiple languages, customise chat texts, video/audio quality).





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# An Analysis of User Requirements for Virtual Classroom/Collaboration Software

Project: P12\_016

September 2012

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## **ABSTRACT**

This report presents an analysis of the university users' requirements for the VCCS in teaching and learning. Originated from the feedback from the university VLE user group meetings, it collates and prioritises the requirements of the university faculties and compares available software in the market to fit for these requirements. It aims to provide detailed information for the INSRV learning technology team to better understand the existing requirements and potential expectations from the user. It hopes that the investigation will be able to give the user an overview of the matter and furthermore provides enough information for the university faculties to make decisions about further strategies.

Through online survey and interviewing, fifteen participants from eleven faculties contributed to this project. The major findings show that using the VCCS to support online training and tutoring is the most urgent requirement; to support online lecture presentation is another crucial expectation; offering solutions for virtual meetings and collaboration considering distance, time and cost is required but is not as urgent as the other two requirements. The findings also reflect pedagogical factors including flexible learning opportunities and flexible teaching approaches. In relation to these requirements, eight VCCS applications are suggested and their advantages and weakness in the use are discussed.

## **ACKNOWLEDGEMENTS**

This report could not have been accomplished without the support from volunteers who share their experience, views and time to help us clarify the requirements for virtual classroom/collaboration software during the project.

I would like to express my special gratitude to the contribution of the library representative. Her additional assistance of evaluation the software is invaluable.

Last but not least, my thanks and appreciations go to my colleagues for providing necessary information regarding the project and for their support in completing the project. Where this report succeeds I share the credit, where it errs, I alone accept the responsibility.

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## LIST OF ABBREVIATIONS

<b>API</b>	An abbreviation of application program interface. It is a set of routines, protocols, and tools for building software applications.
<b>Bb</b>	Blackboard e-Education platform.
<b>CMC</b>	Computer-mediated Communication
<b>EXE</b>	The common filename extension denoting an executable file (a program) in the DOS, OpenVMS, Microsoft Windows, Symbian, and OS/2 operating systems.
<b>IE</b>	Internet Explorer
<b>IM</b>	Instant Messaging
<b>JISC</b>	The Joint Integrated Information Environment Committee
<b>LC</b>	The Learning Central system. It is using the Blackboard Learn platform.
<b>LMS</b>	Learning Management System
<b>SaaS</b>	Software as a service
<b>SSL</b>	Secure Sockets Layer. It is a commonly used protocol for managing the security of a message transmission on the Internet.
<b>VCCS</b>	Virtual Classroom/collaboration software
<b>VLE</b>	Virtual learning environment
<b>VoIP</b>	Voice over IP, Voice over Internet Protocol





# INTRODUCTION

“Virtual classroom” is not a very innovative term to educators. In the early 1990s, educators have started to see the value of using CMC (Hiltz and Turoff, 1993). With the rapid improvement of information technologies, new trends continue to impact on the higher education community, for instance, the increasing percentage of adult learners, minority learners and international students; institutions are becoming more learner-centred, non-linear, and self-directed; a huge growth in Internet usage and technological fluency; lifelong learning is becoming a competitive necessity; more courses, degrees, and universities are becoming available through distance-education programs; and the growing needs for effective course-management systems and web services (Howell, Williams & Lindsay, 2003). Without exception, Cardiff University is facing the effect of the trends too.

Since 2011, the Learning Technology Team has received some requirements in relation to supporting virtual classroom and collaboration learning systems. In the VLE User Group meeting in February 2012, this requirement was raised again. Therefore, to know the users’ requirements for virtual classroom/collaboration software (VCCS) became urgent and were put on the agenda in March 2012.

Based on the original requirements from the VLE User Group (see some comments from the users below), the project that aims to analyse the requirements for the virtual classroom/collaboration software was started.

*“We have been using Elluminate Live for the last few years, and have been very happy with it. In the summer we'll be switching to Blackboard Collaborate 11, as they're phasing out Elluminate. (We have it integrated with our Desire2Learn VLE). We'd be interested in the results of your survey, as we're always open to better (or cheaper!) solutions. Does CU have access to Blackboard Collaborate as part of Blackboard, or are you considering purchasing it?” (by MEDIC - Dermatology)*

*“In summary though, I think we'd have gone for it if it wasn't so expensive. I realise that Blackboard Collaborate is probably a really stable platform and well supported but the School decided against it on cost. It would of course involve a considerable amount of training/education for those who were expected to teach using it and plenty of support for learners too so that is also a bit of a chiller...” (by the school of Nursing and Midwifery Studies)*

*“Used Big Blue Button, Blackboard Virtual Classroom tool, echo 360. A frequent student request is for more synchronous communication tools on our distance learning, eLearning programmes. We hope future programmes will be able to offer real-time tutor-lead feedback sessions and live lectures (webinars). Technical issues, including access and specifications, will need to be considered.” (by MEDIC - Section of Anaesthetics, Intensive Care and Pain Medicine)*

*“No - we haven't used any of these but we are completely overhauling out e-learning course this summer so will be looking at the potential of some of these.” (by the School of Postgraduate Medical and Dental Education)*

The purpose of the project is to collate and prioritise existing user requirements for virtual classroom/collaboration software and to look at tools fit to these requirements. On one hand, it will help the learning technology support members to better understand users' requirements for these technologies. On the other hand, to analyse the available tools in the market will help the learning technology support members to know the technologies better and to fit them to the users' requirements. It is hoped to benefit users who have such requirements and improve learning technology supporting services.

The objectives of the project include:

- Collating the existing user requirements for the VCCS;
- To prioritise the existing user requirements for the VCCS;
- To analyse the available VCCS tools in the market;
- To look at the tools fit to the user requirements; and
- To provide a recommendation regarding options should we wish to look at facilitating use of one or more of these toolsets.

The following chapters describe how the information being gathered, what are the key findings of user requirements, and a review of the good VCCS tools in detail.

## DATA COLLECTION

There were two stages of user requirements gathering in this project. It started on 9 March 2012 and ended on 29 May 2012 (details see Table 1). The data collection methods included literature review, online questionnaire and follow-up face-to-face interviews. At the first stage, information gathering focused on collating user's requirements for functionalities of the VCCS. Twenty-three faculties were invited to participate in this project by a recruiting email sending to Learning Central domain administrators. Fourteen volunteers from ten schools and one representative from the library have participated in the project (participants' details see Appendix 3). All participants were asked to complete an online questionnaire (see Appendix 2). The library representative was also invited to review certain software with the project manager during the later stage of applications comparison.

At the second stage, the participant was invited to a one-to-one interview (40-60 minutes) to discuss more details of their requirements according to their responses to the questions on the survey. The open-ended questions in interviewing focused on understanding what is the participant's experience of using the VCCS? Who are the users of the VCCS in the school? How does the participant use the VCCS? What is the participant's view about the VCCS? What are essential features of the VCCS for the participant?

Following the information gathering, the project manager searched the available tools in the market and evaluated these tools based on the collected requirements from participants. At this stage, literature review and trial testing were adopted as data collection methods. Table 1 shows a timescale of the project.

**Table 1 Project milestones and timescale**

Milestone	Duration	Action date/deadline
Questionnaire design	9 March – 28 March 2012	
Sending recruitment emails to schools		29 March 2012
Data collection – questionnaire	29 March – 23 May 2012	
Data collection – interviewing	10 April – 29 May 2012	1 June 2012
Searching available VCCS tools	20 April – 23 May 2012	
Data analysis – evaluate VCCS tools in regard to user requirements	24 May – 6 July 2012	
Data analysis – review VCCS tools with participants		9 July 2012
Report writing – first draft	25 June – 11 August 2012	
Report completion and submission		31 August 2012

## Questionnaire

Considering the purpose and duration of the project, it is to gather opinion-related qualitative information rather than look to measure data quantitatively. From the viewpoint of supporting learning technology, we do not only want to know what are the user's needs and expectations of the VCCS, but also look at what features in the VCCS are essential for the users. Therefore, a questionnaire was designed to help us to investigate the key features of the VCCS in respect to the user's requirements for a specific educational use, and interviewing was applied to help us to clarify and understand these requirements.

The questionnaire was designed following the criteria as follows:

- Keep the questionnaire as short and succinct as possible;
- Avoid jargon or technical terms unlikely to be familiar to the respondents;
- Avoid double-barrelled questions;
- Do not use leading questions that imply the response that is wanted;
- Include an 'other' option so that people can give commons if the answers are not fit;
- Using the sequence of response categories and values for attitudinal questions to reduce response bias.

In the questionnaire, the questions covering features of a VCCS application were referred to two types of resources. One resource was the evaluation documents from the known application websites, such as Blackboard Collaboration generic vendor evaluation worksheet, Adobe Connect product comparison whitepapers and TeamViewer benchmark. The other resource was the academic papers and research studies about VCCS (e.g., Serce & Yildirim, 2006; Griffin, Friedman & Miko, 2007; Sharma & Gupta, 2012). These resources helped us to classify the VCCS features and design the questions. In Appendix 4, it can be seen that 'the teaching and learning features' covers all functionalities that are needed in online educational activities. The 'administration' includes all features that administrative and support staff concern.

The online questionnaire was created using the Bristol Online Surveys under the Cardiff University Organisational Development's account. It can be seen in Appendix 2.

## Interviews

A semi-structured interview was arranged with the participant after they completed the online questionnaire. The interview location was chosen in order to have the least distraction and the most convenience for the participant. Each interview took time between 40 minutes to an hour. The interviewing questions were open-ended and aimed to collect background, histories and extensive information related to the needs for the VCCS. In short, it focused on the aspects as follows:

- To know the participant's experience of using the VCCS;

- To know the participant's view about the VCCS;
- To understand the participant's purposes of using the VCCS;
- To understand more specific subject-related requirements for the VCCS;
- To know what teaching and learning activities are involved in the use of the VCCS;
- To know who are the target users of the VCCS;
- To know how urgent the requirement for the VCCS is;
- To clarify any doubts about the questions in the survey;
- To clarify the meanings of the relevant aspects of the answers to the questions;
- To give the participant an opportunity to interpret their requirements in detail.

## **Collection of VCCS tools**

A complete list of the VCCS tools that have been viewed either briefly or in detail is displayed in Appendix 5. The collection of the VCCS applications was based on four types of resources. Firstly, some tools have been mentioned in the feedback from the university VLE user group meetings (see the Introduction chapter). These tools were included in the list of available tools. Meanwhile, the tools mentioned by participants through both online questionnaire and interviewing were also added into the list.

Secondly, tools recommended by the VLE or e-learning professional interest groups and organisations were selected and contained in the list. For example, JISC has funded projects and has organised events relating to virtual environment in the field of pedagogic innovation. The information is very useful for this project. The eLearning Guild, a community of practice for e-learning professionals provides a variety of resources that assist members in their efforts to develop and improve e-learning in their organisations. PC Magazine has ranked the best Web Conferencing solution in 2011.

Thirdly, the research papers and academic journal articles are reliable resources for people to know useful tools in education settings. For example, Kathy Michael (2012) looked into the reflections of online classes with Elluminate Live and addressed the requirements such as increased flexibility and cost reductions. Jones, Kolloff & Kolloff (2012) compared web conferencing programs WebEX and AnyMeeting, and suggested that the impact of web conferencing on education is continuous. These types of tools should not be ignored.

Finally, the awards for learning technology products were quick sources for people to know the best VLE tools and e-learning solutions. For example, the Wimba Collaboration Suite was awarded as the 2009 'Best Education Solution' and the 2010 'Best Collaboration Solution' CODiE award by the Software & Information Industry Association. WizIQ won the Jury-Award for 'Best Virtual Classroom Provider' in the Global e-Learning Awards 2012 in the World Education Congress. Adobe Connect Pro, Citrix Online GoToTraining, and Cisco WebEx TrainingCenter were the winners of the Best Virtual Classroom 2011 announced by the Elearning Media Group. These types of VCCS tools were collected into the list too.

# THE ANALYSIS OF USER REQUIREMENTS

Based on the information gathered from the fifteen participants, this section outlines the crucial requirements in connection with different purposes of using the VCCS and the important common requirements that matter to the user.

## Views of using the VCCS

What is virtual classroom/collaboration tool and how well do the users know the virtual classroom/collaboration tools? To know these answers will help us to see the user's standpoint and reduce misunderstanding of the topic.

In the recruitment email, the project manager provided a definition of the virtual classroom tools (see Appendix 1):

*A virtual classroom is an online service to support both synchronous and asynchronous e-learning activities. It may involve overlapping scopes of interaction such as virtual courses, online meeting, and online presentation. It supports activities and interactions through functionalities such as video, voice, chat, screen sharing, webinar, whiteboard, threaded discussion boards and so on.*

According to the participant's experience of using the VCCS, there are different knowledge levels of the VCCS and different expectations for its use.

Participants, who have experience of using the VCCS previously or presently, have relatively clearer view of what the VCCS is and what the limits are. They understand the technological issues in an application. They expect that the VCCS is a robust and reliable system, and it is easy to fit their specific requirements. For example, Bill stated "*A frequent student request is for more synchronous communication tools on our distance learning, eLearning programmes. We hope future programmes will be able to offer real-time tutor-lead feedback sessions and live lectures (webinars)*".








Participants, who have heard of the VCCS or attended a couple of VCCS webinar sessions but do not use any VCCS at present, have noted the potential of using the VCCS. They plan to use the VCCS in teaching and want to get suggestions from other experienced VCCS users. They want to develop more flexible learning environment for learners. Using Farina's sentence as an example, "*We have wide range of courses. We expect trainees are able to access to live sessions at any location and can playback training sessions later when they have time*".

Participants, who have little experience of using the VCCS, are interested in knowing more and keep an open mind. They expect to know what the VCCS can do and its potential use in helping their particular subjects. For instance, Gloria said "*Students asked if there are course broadcasts available in Learning Central? if they can access and playback some teaching*

sessions after the class? I think it will be useful if I can use virtual class tools to design and manage my course and provide students more flexible learning experience”.

## The use of the VCCS

In the questionnaire, to help understand the user’s purposes of using the VCCS, a question “Basically, what do you (or would you like to) use the virtual collaboration tools for?” has been asked. It can be seen in Figure 1 that most user apply the VCCS to support learning and teaching activities, to interact with distance learners, to make lecture presentation, and to run web meeting or conferences. Applying the VCCS for instant messaging, audio authoring/podcasting and IT support are mentioned too, however, they are not the major uses of the VCCS. According to participants stated later, they have been using some excellent tools such as Skype (<http://www.skype.com/intl/en-us/home>) for instant chat/messaging and Audacity (<http://audacity.sourceforge.net/>) for voice authoring, but they have not had a robust VCCS tool for the virtual classroom use.

5. Basically, what do you (or would you like to) use the virtual collaboration tools for?		
Support Learning and Teaching activities:		13
Interact with distant learners:		12
Web meeting/conferencing:		10
Instant messaging:		4
Lecture presentation:		11
Voice authoring (e.g., Voice Presentation, Voice Email):		7
Other (please specify):		1
I use it for tech support - desktop sharing. Skype has desktopsharing but Blackboard Collaborate also has remote control.		

**Figure 1 The purposes of using the VCCS**

By further interviews with participants in terms of their responses to the questionnaire, six key aspects of requirements relating to their purposes of use the VCCS are emerged. They are listed below.

- Using the VCCS for training and tutoring,
- Using the VCCS to support lecture presentation,
- Using the VCCS to run virtual meetings,
- Using the VCCS to enhance flexible learning experience,
- Using the VCCS to provide flexible teaching approaches, and
- Support subjects and special needs related to e-learning.

At the same time, the core theory occurred here is *Flexible Learning*. According to Collis and Moonen (2004), the theory is reflected on three dimensions from the data. At first, the requirements for flexible access learning content. Some participants mentioned that more and more students (including campus-based students) asked whether the teaching sessions can be available online for them to access later. Secondly, the requirements for flexible learning regarding to time and location. Participants noted that distance learners who take online

courses need to join a live session or access to various online resources from different locations and time zones at the same time. Hence, as the third point, schools want flexible services to support online learning activities and teaching staff need more flexible approaches to delivering e-learning modules. It can be seen that the requirements for the VCCS are learner-centred. People want a flexible learning environment over the traditional classroom so that teaching and learning can fit into their lifestyle. In the following sections, it will indicate the six aspects of the requirements.

### **Training and tutoring – small groups (less than 20 people)**

Using the VCCS as an approach to supporting training or tutoring is a crucial requirement. The requirements are basically from people who deliver online trainings and who run online tutorials for distance students. This group of users have adopted one or two VCCS tools to support their learning activities and they need the VCCS urgently.

University libraries run amount of training courses to support the development of learning outcomes for information literacy, for instance, bibliographic training (e.g., Medline, PsycINFO) and how to use reference management software (e.g., EndNote). To support students who are off-campus and who undertake online certification courses, some librarians are using BigBlueButton to run online training sessions. It allows learners to attend an online training without being in the training room. The most urgent requirement is that a live training session can be recorded by moderators and it can be replayed by learners. The value of using the VCCS is: make training courses easier for both moderators and distance learners; create reusable learning resources; and provide learners flexible learning environment.

The Cardiff Centre for Lifelong Learning offers a range of interesting and useful courses to individuals and business. They have 400 lifelong learning courses (e.g., language, computer studies, and international marketing) at present and the learners are at all levels. They want to use more flexible tools to support learning activities, especially for people who are busy or difficult to travel to the centre to take a course. The most urgent requirement is to have an easier approach for learners to join in a training session no matter their locations. Similar to the training courses run by libraries, trainers in the centre want to make recorded training sessions to be accessible for learners. The value of using the VCCS is: learners are able to attend training course in different locations and time zones; learners can learn at their own pace; create reusable learning resources; and save travelling cost and time.

Schools that provide e-learning certification courses or have students away in a period time for subject related practice expect to use the VCCS to run online tutorials. For example, in the Institute of Translation, Innovation Methodologies & Engagement, tutors use Skype to support distance learners. The tutor arranges a date/time for distance students and at the time, students will join in and ask questions. Basically, they use audio messaging and chat functionalities. It is difficult for them to organise group work or group discussions on Skype. Skype tutorials do not work with Learning Central too. They expect to have more features in one system that allows them to facilitate distance students with more flexible approaches. The



value of using the VCCS is: provides better support for distance learners with regard to different time and places; check learners' progress and understanding of the course, and improve the quality of e-learning courses.

This type of requirements is categorised based on the common factors as follows:

- Small numbers of attendees (maximum 20 attendees);
- Learners who are unable to attend a session on the site and/or at a specific date/time can join in a session no matter their locations and their time (e.g., distance learning students, business or the individual who have limited time);
- Learners may be at different levels (e.g., different language background in a language training course, different levels of literacy skills in a library databases searching course);
- 1-2 moderators may lead a session;
- A variety of learning activities to engage learners (e.g., play presentation slides, quizzes, access to external web resources, play a live video);
- Support group work and discussions;
- One-to-one, one-to-many or many-to-many style of interaction (e.g., allow attendees to chat to each other).

Table 2 outlines the most essential features of the VCCS if it is used for the purpose of supporting small group online trainings or tutoring.

**Table 2 User's key requirements for the VCCS in the use of training/tutoring**

Key requirements	Required VCCS features	Feature categories
Be able to see attendees	Control of sharing video/ webcam by individual	Communication
	Icons of capabilities by attendees (e.g., microphone, webcam)	
	Alerts of activities (e.g., new message, users joined, left, notifications)	
Allow a small group of attendees join a live session	Support 1- 20 attendees at the same time	Supported communication channel
Be able to schedule sessions	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)	File transfer
	Email attendees and guests to a scheduled session	Communication
Be able to communicate with attendees synonymously	Textual public messaging	Communication
	Textual private messaging	
	Audio	
	Video/webcam	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	

Be able to check if attendees understand and follow	Allow attendees to share their screen	Application/Screen sharing
	Quizzes	Quiz/Survey
	Polling	Feedback/polling
Be able to see/show a attendee's screen	Screen sharing or Remote control	Application/Screen sharing
Be able to record the training session	Sessions recording	Capture/record/playback
Be able to view a recorded session afterwards, edit it and control to allow people to play back	View and edit recorded sessions	Capture/record/playback
	Control access to recorded sessions	
	Session playback	
Be able to access sessions by mobile devices and work well with other systems	Support mobile devices access	Integration with internal/external tools and services
Be able to check chat history	Save chat history or record it in a session	Communication
Be able to play multimedia files	Support various types of multimedia files	Live video & Audio streaming
Be able to let attendees to see relevant applications	Application sharing	Application/Screen sharing
Allow attendees to customise screen	Customise chat text (font, size, colour) by individual	Communication
	Resize videos and control full screen video by individual	Live video & Audio streaming
Easy for people to test facilities (e.g., microphone, speaker, webcam)	Audio/video wizard or help	Live video & Audio streaming
Be able to publish web URLs and allow trainees to access the website	Web tour	Integration with internal/external tools and services
More than one demonstrators in a session	Allow multiple people have moderator roles	Participant list & right management
Allow group work	Breakout rooms	Breakout rooms
	Whiteboard	Whiteboard
	Textual public messaging	Communication
	Textual private messaging	
	Audio/video	
	File transfer	File transfer
Low cost as no budget or no funding	Free version or low cost	Pricing

### **Lecture presentation – large groups (50-300 people)**

Some participants noted that they have large group of students in a lecture classroom (normally more than 100). They encounter issues such as it is difficult to check students' attendance, the shortage of big lecture theatres in the university, and the lack of flexible learning opportunities for students. If the VCCS can be used to record lectures, they will gain

benefits from aspects such as: (1) give students more learning opportunities, (2) allow lecturers to review their own teaching, (3) support accessible learning content, and (4) encourage reflection. The needs for the VCCS from this group of users are crucial too.

Participants from three different schools said that they use lecture capture program at present. The School of Mathematics uses JANET Access Grid, a designed videoconferencing application with facilities for collaborative teaching. Around 20 universities in the MAGIC group (<http://maths-magic.ac.uk/index.php>) are using it. The system uses audio and video tools that allow people in different locations to meet in a virtual venue (e.g., a lecture room having multiple cameras and multiple displays installed) and it allows users to share their desktop to other sites. The Law School uses Panopto (<http://www.panopto.com>), an institutional lecture capture system designed for people to capture, manage, search and view multimedia presentations online. To an extent, the system does not designed for distance learners to attend an online live course; rather the school integrates it within Learning Central to provide students a virtual learning environment and allows students to playback the lecture sessions. The Department of Dermatology has been using Elluminate Live for three years and will use Blackboard Collaborate this summer because Elluminate Live has been acquired by Blackboard. They use the system to support lecture presentations of online courses for distance learners, parallel meetings, community meetings, and student panel meetings. This is a typical example of how the VCCS has been used in higher education.

Different from the requirement for supporting small group training and tutoring, people who want to use the VCCS to capture lecture presentations and provide flexible learning environment for students have highlighted sharing, accessibility to high quality learning content, enhancing learning opportunities, and low cost approaches to managing widespread e-learning courses. This type of requirements is categorised based on the factors as follows:

- Large numbers of attendees (minimum 50 attendees, normally over 100 attendees);
- Live video presentations to geographically dispersed learners;
- High quality presentations;
- Record live sessions and edit it before publishing for on-demand access;
- The lecturer or presenter leads a session and moderators moderate in due time;
- Using learning activities to engage learners during the session (e.g., quizzes, polling, survey);
- One-to-many or a few-to-many style of interaction (in a lecture, it has little time for group discussions).

Generally speaking, lecture capture system “includes a suite of software applications with specifications for preferred hardware, which typically consists of items such as a camera and a microphone that are available in many classrooms... These applications integrate with audio visual hardware to capture a lecture” (EDUCAUSE Learning Initiative, 2008). As participants (e.g., Nursing and Midwifery Studies, Biosciences) pointed out, previously, recording lectures would involve filming the screen and presenter with a camcorder which is time consuming and requires special equipment, and often results in a poor quality

video. With the development of technologies, many web-based VCCS applications now are able to produce good quality videos with basic hardware such as headset, webcam and good bandwidth. Using the VCCS in a lecture is not an excuse for students (especially campus-based) to not go into classes; rather it seeks to enhance instructional activities. In a specific subject area, it benefits students from repeated viewing of content, especially when complex items are being discussed. Schools (e.g., the Section of Anaesthetics, Intensive Care and Pain Medicine, the Pharmacy and Pharmaceutical Sciences) that run e-learning courses or have increasingly collaborative/international courses expect that the VCCS can support a large group of distance learners to attend an online lecture synchronously. Considering the time of a lecture, there are fewer requirements for features that support group work, such as breakout rooms and file transferring. Here, the urgent demand is that the VCCS supports a large number of attendees in a live lecture session.

Table 3 displays the most essential features of the VCCS if it is used for the purpose of supporting large group of learners in an online lecture.

**Table 3 User's key requirements for the VCCS in the use of lecture presentation**

Key requirements	Required VCCS features	Feature categories
Be able to see attendees	Icons of capabilities by attendees (e.g., microphone, webcam)	Communication
	Alerts of activities (e.g., new message, users joined, left, notifications)	
Allow a large group of attendees join a live session	Support at least 50 attendees at the same time	Supported communication channel
Be able to schedule sessions	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)	File transfer
	Email attendees and guests to a scheduled session	Communication
Be able to communicate with attendees synonymously	Textual public messaging	Communication
	Textual private messaging	
	Audio	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing)	
Be able to check if attendees understand and follow	Polling	Feedback/polling
	Quiz or survey	Quiz/Survey
Be able to record the session	Sessions recording	Capture/record/playback
Be able to view a recorded session afterwards, edit it and control to allow people to play back	View and edit recorded sessions	Capture/record/playback
	Control access to recorded sessions	
	Session playback	
Be able to access sessions by mobile devices and work well with other systems	Support mobile devices access	Integration with internal/external tools and services

Be able to check chat history	Save chat history or record it in a session	Communication
Be able to play multimedia files	Support various types of multimedia files	Live video & Audio streaming
Be able to let attendees to see relevant applications	Application sharing	Application/Screen sharing
Allow attendees to customise screen	Resize videos and screen by individual	Live video & Audio streaming
Easy for people to test facilities (e.g., microphone, speaker, webcam)	Audio/video wizard or help	Live video & Audio streaming
Different control roles in a session	Allow multiple people have presenter or moderator roles	Participant list & right management

## Virtual meetings

Applying the VCCS to host online meetings has been mentioned by a few participants although it is not the most often mentioned usage.

Nowadays, online meeting and conferencing software is increasingly used by organisations to support events considering distance and time zones. Some participants expect the VCCS allows anyone, anywhere to instantly share their desktop and ideas online with others. It will save money, travel less, and collaborate easily.

For example, Marco stated that he attended virtual meetings using VenueGen, which is an immersive virtual collaboration lab and classroom application. He described that the software allows people in different locations with different time zones to meet and discuss research studies easily. The software allows users to impose their own face over an avatar. This makes him feel that there are real people in a real setting. As he also teaches in another university in another city, the software allows him to have a meeting with colleagues in another university easily. It saves his time and travel cost. He keeps an open mind and thinks that the VCCS will provide students and staff more flexible ways of interaction considering time and locations.

Jaime mentioned that the school has been using Elluminate Live for parallel meetings, social community meetings and student panel meetings. These online events benefit people in the school because it is easy to host a meeting and it offers convenience for people to attend a meeting without having to be in the same venue.

Bill suggested that they need to use the VCCS to organise online meetings and conferences with partner companies. In the school, there are 150 to 300 distance learners who undertake the e-learning courses. Besides the requirements for the VCCS to support lecture presentation for a large group students, another urgent requirement from the school is that the VCCS can be applied to host virtual meetings and attendees can download files in a virtual meeting.

This type of requirements is categorised based on the factors as follows:

- Attendees are at different locations and/or time zones;
- Attendees communicate through audio;
- Multiparty video (e.g., attendees can see each other);
- Play presentation slides;
- Whiteboard and/or screen/application sharing;
- Many-to-many style of interaction.

The key requirements are outlined in Table 4.

**Table 4 User's key requirements for the VCCS in the use of virtual meetings**

Key requirements	Required VCCS features	Feature categories
Real-time interactions	Audio	Communication
	Video	
	Textual public messaging	
	Textual private messaging	
	Whiteboard	Whiteboard
Allow a group of attendees join a live meeting	Support a small group of attendees at the same time (e.g., 20 attendees)	Supported communication channel
Be able to schedule meetings	Upload files (e.g., presentation slides, multimedia files) and play files	File transfer
	Email attendees and guests to a scheduled meeting	Communication
Be able to invite new participants while a meeting is in progress	Email attendees and guests to a scheduled meeting	Communication
High quality of video images and audio	Video and audio	Live video & Audio streaming
Be able to access a live meeting by mobile devices	Support mobile devices access	Integration with internal/external tools and services
Be able to share desktop	Screen sharing	Application/Screen sharing
Be able to let attendees to see relevant applications	Application sharing	Application/Screen sharing
Be able to pass controls to other participants	Allow multiple people have presenter or moderator roles	Participant list & right management
Be able to record meetings	Recording meetings	Capture/record/playback
Be able to playback recordings	Playback recorded meetings	Capture/record/playback
Be able to play multimedia files	Support various types of multimedia files	Live video & Audio streaming
Allow attendees to customise screen	Resize videos and screen by individual	Live video & Audio streaming
Easy for people to test facilities (e.g., microphone, speaker, webcam)	Audio/video wizard or help	Live video & Audio streaming

## **Flexible learning experience for students**






According to pedagogical perspectives, providing students a more flexible learning environment is increasingly highlighted in higher education. This demand implies on two aspects: on one hand, the processes of education are under challenge through flexible choices for students in relation to the needs of individuals in a diverse and rapidly changing social context; on the other hand, the universities are facing shift resulting from finance crisis, advancing technology, the demography of students, and progressively requirements from students for podcast and available lecture resources. In this project, participants pinpointed the VCCS usage to enhance the student's flexible learning experience.

Considering distance learners, the VCCS can help to enable individuals to engage in various learning situations and opportunities in optimal ways. It needs the VCCS to satisfy the requirements as follows:

- Learners are able to join in e-learning live lectures/tutorials synchronously from different locations and/or time zones;
- Learners can apply audio and video communications over the Internet;
- Learners can attend an online learning activity via the most popular operating systems with the most popular web browsers (e.g., IE, Safari, Google Chrome, Firefox);
- Learners can access learning resources anytime via the most popular operating systems with the most popular web browsers (e.g., IE, Safari, Google Chrome, Firefox);
- Learners can attend an online learning activity using mobile devices or iPad;
- Learners can access learning resources anytime using mobile devices or iPad;
- Learners can communicate with lecturer/tutors/moderators easily in an online learning activity;
- Distance learners can communicate to each other easily in an online learning activity;
- Enable learner groups to work together without having to meet in a physical venue;
- Learners are able to change interface language;
- Learners are able to customise screen and change settings (e.g., font size, font colour, background);
- Learners can call the lecturer/tutor's attention easily in an online session;
- Learners are able to leave feedback for the lecturer/tutor/moderator easily;
- Allowing learners to download learning materials (including recorded courses) and to review materials will make learners to feel a complement to in-class interactions;
- Providing learners a seamless virtual learning environment.

Among the ten academic departments that have participated in the project, the Department of Dermatology is using Desire2Learn VLE rather than LC. From the questionnaire data (see Figure 2), it can be seen that more than half of the participants expected the VCCS can be integrated into LC. In the interview, one participant from the School of Medicine mentioned clearly that the integration of VCCS into LC will benefit students from their learning

experience as all their online courses are in LC. Some participants noted that it will be useful if VCCS provides a functionality that allows the user in a VCCS session to access learning materials in LC, or users can access a VCCS session through LC.

19. Do you require integration with internal/external tools and services?			
19.d. Learning Central			
No interest:		6.7%	1
Some interest:		13.3%	2
I would use this feature:		26.7%	4
Quite important to me:		33.3%	5
Essential to me:		20.0%	3

**Figure 2 The expectation of integrating the VCCS into LC**

In detail, the features of the VCCS fitting to the requirements are listed in Table 5.

**Table 5 User’s key requirements for the VCCS to enhance flexible learning experience**

Key requirements	Required VCCS features	Feature categories	
Allow attendees join a live session	Support both small and large group of attendees at the same time	Supported communication channel	
Be able to apply audio communications	VoIP	Communication	
Be able to apply video communications	Sharing video/ webcam	Communication	
Be able to access sessions by different operating systems with the most popular web browsers	Support different operating systems	Integration with internal/external tools and services	
	Runs on different web browsers		
Be able to access sessions by mobile devices	Support mobile devices access	Integration with internal/external tools and services	
Be able to access a VCCS session through LC or in a VCCS, to access to learning materials in LC	Provide a way of integrating VCCS into LC	Integration with internal/external tools and services	
Be able to communicate with other attendees easily & Be able to communicate with lecturer/tutors/moderators easily	Textual public messaging	Communication	
	Textual private messaging		
	Audio		
	Video/webcam		
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Application/Screen sharing	
	Sharing screen and applications		
	Using whiteboard		Whiteboard
	File transfer		File transfer
Be able to play multimedia files	Support various types of multimedia files	Live video & Audio streaming	



Be able to let attendees to see relevant applications	Application sharing	Application/Screen sharing
Group work	Breakout rooms	Breakout rooms
	Using whiteboard	Whiteboard
	Screen sharing or Remote control	Application/Screen sharing
	Textual public messaging	Communication
	Textual private messaging	
	Audio/video	
	File transfer	File transfer
Multi-language interface	Support multiple languages	Service/support
Learners are able to customise screen	Customise chat text (font, size, colour)	Communication
	Resize videos and control full screen video	Live video & Audio streaming
Be able to leave feedback	Polling	Feedback/polling
Download learning materials	Access to learning resources	File transfer
Be able to view a recorded session	Control access to recorded sessions	Capture/record/playback
	Session playback	

### **Flexible teaching approaches for educators**

Similar to the requirements for enhancing students learning experience, participants expected that the VCCS provide additional approaches for teaching. The requirement for using technologies like the VCCS to support teaching is not just a new option, but an inevitable shift in the educational paradigm resulting from fundamental changes in the social context.

Many academic schools have joined into the international higher education market through a combination of national courses and international courses. For example, the School of Nursing and Midwifery Studies provide international modules and staff needs to teach in Oman. The School of Pharmacy and Pharmaceutical Sciences runs collaborative courses with Taylor's University in Malaysia. Using the VCCS to support teaching collaboratively is one of the important requirements. It indicates on three aspects as follows:

- Participants expected that the VCCS is able to allow external people (e.g., a patient representative, NHS staff, or a guest lecturer) who are geographically elsewhere to join a class easily. It will be convenient for the external people because (1) they can control to use video or audio by themselves if they do not get used to speak in front of a large group of students, (2) it reduces risk and cost if they have mobility or health problems that make travel difficult, or (3) it provides alternative ways for them with respect to different user preferences.
- Participants expected that the VCCS is able to allow multiple educators in different places (e.g., different universities) to take responsibility for planning, designing, monitoring and teaching a course together. It will benefit teaching, especially some subjects because (1) it provides an option for academic staff who are specialised in an

area to deliver high quality teaching content together, (2) it allows academic staff who work irregular hours, shifts or in different locations to arrange time and work together easily, or (3) it allows educators to pre-record sessions and rehearsal.

- It reduces the need to book a quiet meeting room. Participants expected that the VCCS allows academic staff to organise discussions or meetings easily considering different available hours and locations.

Schools such as the Section of Anaesthetics, Intensive Care & Pain Medicine and the Institute of Translation, Innovation Methodologies & Engagement provide e-learning MSc courses. To an extent, e-learning is to give learners the freedom and flexibility to learn when and where they want, and at their own space. Some participants expected that the VCCS provides flexible ways for the course designer to deliver e-learning courses easily. The requirements reflect on following aspects:

- The lecturer can schedule an online session in the VCCS;
- The lecturer can schedule the number of attendees (e.g., 1-20 attendees for tutorials; 50-300 attendees for lectures);
- The lecturer can upload learning materials onto a scheduled session and review it in advance;
- The lecturer can invite attendees by email during a session and/or before a session starts;
- The lecturer has controls on the attendee's activities such as share video/audio, download files, drawing on the whiteboard, send private messages to other attendees, and upload files, conduct quizzes, and share screen and applications;
- The lecturer controls the attendee's roles such as a presenter, a moderator, or a guest;
- The lecturer is able to play multimedia learning content;
- Interaction between the lecturer and attendees needs to be supported through the VCCS features such as video, audio, chat, whiteboard, polling, sharing screen;
- The lecture capture technology in the VCCS allows the simultaneous recording of audio, video, PowerPoint, chat messages, and screen sharing;
- The lecturer can review and edit a recorded session;
- The lecturer (referring to the school policies) can control whether a recorded session can be accessible on the web;
- The lecturer can trace a student's attendance and learning outcomes by checking reports or statistical information created by the VCCS;
- The lecturer can view a distance learner's profile and check back the chat history in a recorded session. This is to help the lecturer to better understand their students and improve teaching quality.

As discussed in a previous section, the university is short of large lecture theatres, participants expected that the VCCS will provide lecturers an alternative way of lecturing. Additionally, teaching through the VCCS will give the student who is unable to go to the classroom or who missed a session more learning opportunities.

The key features of the VCCS for supporting flexible teaching approaches are displayed in Table 6.

**Table 6 User's key requirements for the VCCS to support flexible teaching approaches**

Key requirements	Required VCCS features	Feature categories
Allow external people join during a live session	Invite external people by email	Supported communication channel
Be able to schedule sessions	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)	File transfer
	Email attendees and guests to a scheduled session	Communication
	Review and edit a scheduled session	Service/support
Allow a large group of attendees join a live session	Support 50 or more attendees at the same time	Supported communication channel
Allow a small group of attendees join a live session	Support 1-20 attendees at the same time	Supported communication channel
Be able to play slides	Support presentation files and images (e.g., ppt, pdf, jpg, html)	Live video & Audio streaming
Be able to play multimedia files	Support various types of multimedia files (e.g., swf, qt, wmv, mpg, mp3, m4v)	Live video & Audio streaming
Have controls in a session	Allow multiple people have presenter or moderator roles	Participant list & right management
	Allow attendees to share video/audio	Application/Screen sharing
	Allow attendees to upload files	File transfer
	Allow attendees to download files	File transfer
	Allow attendees to drawing on the whiteboard	Whiteboard
	Allow attendees to send private messages to other attendees	Communication
	Allow attendees to share screen or applications	Application/Screen sharing
	Resize videos and control full screen video	Live video & Audio streaming
Have tools to help the lecturer to engage attendees	Textual public messaging	Communication
	Textual private messaging	
	Audio	
	Video/webcam	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	
	Sharing screen and applications	Application/Screen sharing
	Whiteboard	Whiteboard
	Polling	Feedback/polling
	Breakout rooms	Breakout rooms
	Quizzes	Quiz/survey

Be able to view and edit a recorded session	Review and edit a recorded session	Capture/record/playback
	Control access to a recorded session	
Can trace a student's attendance	User tracking	Usability

### **Support subjects and special needs learners in e-learning**

Besides the above requirements concerning different purposes of using the VCCS, there are some specific requirements in respect to subjects.

For the School of Mathematics, being able to use mathematics symbols on the whiteboard is essential. This requires the VCCS to have an extensible architecture that allows addition of new tools, such as mathematical symbols and scientific notation.

For the School of Nursing and Midwifery Studies, the student's attendance is important information for instructors to assess the student's learning outcome and course satisfaction. They expect that the VCCS has functionality either captures the student's attendance or produces report summarising the student's sign-in, attendance and engaging with online courses.

For the School of Dermatology, e-learning courses use a large number of images and multimedia files as learning content. It requires the VCCS is able to support both large file management and high quality live video streaming.

Participants from the School of Pharmacy and Pharmaceutical Sciences and the Centre of Lifelong Learning have stated that students who have dyslexia or vision problems may need assistive tools. Thus, features such as being able to customise font colour, font size, background colour, and screen size are indispensable for users with learning disabilities.

The library representative and participants from the Centre of Lifelong Learning stated that the training courses support a large range of international learners, who may request language support. The VCCS which supports multi-language benefits users from the self-help features.

Therefore, when review the VCCS, the subject-related features and special needs related functionalities should not be ignored.

### **Key common requirements**

Generally speaking, common requirements should not be taken for granted but be emphasised as the essential requirements for the VCCS. In Figure 3 and 4, it shows the results of relevant questions that have been asked in the questionnaire.

At first, "easy to use" is vital for participants. However, it is no doubt that different people may have different views about how easy a system is. To clarify it, questions about common operation such as "simple and easy to navigate", "organised and easy to follow structure",

“easily and quickly transit between different types of content” and “automatic reconnection if the Internet outage occurs” have been asked. It can be seen in Figure 3 that more than half of the participants highlighted that it is essential or quite important to them.

Secondly, the VCCS “runs on all major computer platforms” is very important for users. Nowadays, Microsoft Windows is not the only operating system that students and staff use. Mac OS and Linux are increasingly used too. In addition, to support mobile device access is one of the most often asked requirements. Although in the questionnaire the result (see Figure 4) does not display the distinction between different aspects of demands for mobiles; in the interviews, participants have pointed out the importance of supporting access the VCCS through mobile devices.

Thirdly, “runs on all popular web browsers” is another requirement for the VCCS. A university PC runs supported web browsers for e-learning systems, however, a distance learner may use an unsupported web browser or a different version of the web browser. To make sure the learner has positive experience, the VCCS need to run on the most popular web browsers such as Google Chrome, Safari, Firefox, and IE.

Last but not least, “a robust and reliable system” is fundamental for people who want to use the VCCS. Every participant has experience of using VLE. For them, the VCCS should be reliable and stable for users. If the VCCS is difficult to use or have operating matters for education use, the users will feel it wastes their time. Meanwhile, for VLE technologists or support officers, it will be hard for them to convince lecturers or academic staff to change their ways of traditional teaching (that is, they do not want to try new learning technologies). It is clear that there is no a perfect system that fits all requirements, however, for the user, the VCCS product should be developed well and stable for a specific purpose of use.

7.a. Simple and easy to navigate			
No interest:		0.0%	0
Some interest:		6.7%	1
I would use this feature:		0.0%	0
Quite important to me:		26.7%	4
Essential to me:		66.7%	10
7.b. Organised and easy to follow structure			
No interest:		0.0%	0
Some interest:		0.0%	0
I would use this feature:		6.7%	1
Quite important to me:		26.7%	4
Essential to me:		66.7%	10
7.c. Easily and quickly transit between different types of content			
No interest:		0.0%	0
Some interest:		0.0%	0
I would use this feature:		6.7%	1
Quite important to me:		40.0%	6
Essential to me:		53.3%	8
7.f. Automatic reconnection if the Internet outage occurs			
No interest:		0.0%	0
Some interest:		0.0%	0
I would use this feature:		20.0%	3
Quite important to me:		26.7%	4
Essential to me:		53.3%	8
9.a. Be able to test your audio locally			
No interest:		0.0%	0
Some interest:		13.3%	2
I would use this feature:		13.3%	2
Quite important to me:		20.0%	3
Essential to me:		53.3%	8
9.c. Audio/webcam setup wizard			
No interest:		0.0%	0
Some interest:		0.0%	0
I would use this feature:		13.3%	2
Quite important to me:		53.3%	8
Essential to me:		33.3%	5
15.c. Easily setup for external contributors			
No interest:		0.0%	0
Some interest:		13.3%	2
I would use this feature:		13.3%	2
Quite important to me:		40.0%	6
Essential to me:		33.3%	5








**Figure 3 The requirements for “easy to use”**

19.b. iPhones/Blackberry devices			
No interest:		6.7%	1
Some interest:		26.7%	4
I would use this feature:		20.0%	3
Quite important to me:		20.0%	3
Essential to me:		26.7%	4

**Figure 4 The requirements for the VCCS integrating with mobile devices**

## COMPARISONS OF THE VCCS

In the survey, participants have noted some software products which they have used before or are currently using for teaching or supporting learning activities. The software includes: Dimdim, BigBlueButton, Vyew, Google+ hangouts, Adobe connect, Zoho Meeting, Skype, Elluminate Live, and Wimba Live classroom (see Figure 5).

4. Please let us know if you have used or intend to use any virtual collaboration tools below.	
Blackboard - Virtual classroom: 	7
Blackboard - Chat: 	6
Elluminate Live: 	4
Wimba classroom: 	2
BigBlueButton: 	4
Blackboard Collaborate: 	4
Other (please specify): 	9
Access Grid	
adobe connect, google hangouts, skype, Vyew, Zoho Meeting	
Blackboard	
DIM DIM Vyew	
Don't think I've used any of these at the moment, but wouldn't rule out using in the future	
I haven't used any of these - the Blackboard tools don't seem to work well but I'd be interested in trying some of the others listed here.	
In the past, we have also used Talking Communities and Adobe Connect.	
Those are the only 2 I have heard of. I currently use Skype for online tutorials	
VenueGen	

**Figure 5 The software products noted by participants**

DimDim does not provide free version any longer and has been dismissed by the participant so that it was not reviewed. Vyew and Zoho Meeting free versions have many limits and do not have enough features that participants need. They were not tested. Elluminate Live and Wimba Live classroom were purchased by Blackboard Inc. in 2010 and it was titled as Blackboard Collaborate. Therefore, Blackboard Collaborate was reviewed. According to the library representative's description, they were using BigBlueButton set up by JISC and their concern is that it might not be supported in the future and it does not have the recording functionality at present. Similarly, the participant from the Institute of Psychological Medicine and Clinical Neurosciences mentioned a lacking of recording feature in the free version of BigBlueButton too. Thus, this software was not tested. To use Google+ hangouts needs users to have a Google account (with a Google+ profile) and to install a browser plug-in. In terms of the requirements for "easy to use" for educators and students, this product was not tested.

The available VCCS on the market were shown in Appendix 5. Based on the availability, the VCCS products were associated into three groups: free register version software, free trial version software and non-free-access version software. The non-free-access version software were not tested because they did not provide a trial version (see the grey colour texts in Appendix 5), request to register credit card information to try a trial version (see the chocolate colour texts in Appendix 5), or need certain member permissions to access (e.g., AccessGrid, see the green colour texts in Appendix 5). The following section will focus on

the evaluation of tools in the group of free register version software and the group of free trial version software.

To clarify, the evaluation of the VCCS is not comprehensive on the following aspects considering limitations of the availability of testing facilities, testing members and the project duration:

- Using mobile devices to access the VCCS was not tested;
- The VCCS running on Linux system was not tested (running on Windows XP SP3 and Mac OS X 10.6.8 was tested);
- The VCCS running on web browsers (Firefox 13.0.1, Firefox 12, Safari 5.1.7, Google Chrome 20, IE 8) was tested;
- A large group of attendees synchronously joining in a live session was not tested. Generally, three to five attendees synchronously joining in a live session were tested;
- It did not test every feature of a VCCS product. Basically, the evaluation focused on testing the features required by participants (see analysis in the previous section);
- Because this is not a marketing research, the VCCS tools in Appendix 5 do not include all available tools on the market.
- Some VCCS applications were dismissed because they do not provide a free trial version or need credit card information to register. It does not say this type of applications is not good enough.
- To avoid inadequacies and biases to a VCCS product, methods such as reviewing support information on the producer's website, comparing product reviews by third parties, and asking participants' opinions about the application have been used.

## **Toolset 1 – Free register version software**

As shown in Appendix 5, 16 VCCS products offer a free version. Except the tools such as Google+ hangouts, Vyew and Zoho meeting that have been dismissed, 13 VCCS products have been reviewed and 3 out of 13 tools (AnyMeeting, TeamViewer, and Wiggio) contain the key features regarding a specific required use. Appendix 6 presents a brief comparison of the 10 VCCS products. Below the three good tools will be discussed in detail.

### **AnyMeeting**

<http://www.anymeeting.com/>

AnyMeeting is a tool for those who want to host web conferences in an easy and professional manner, but without the high-costs. It delivers online meeting platform as a SaaS. It was founded in October of 2009 under the name Freebinar. It was originally designed to provide the Internet users with an effective, professional way to host meetings with less hassle. It has a high ranking of reviews in the sense of meeting with anyone, anywhere for free.

The requirements for using AnyMeeting include:



- Install the latest Java
- Install the latest Adobe Flash Player

The features of AnyMeeting have been outlined on their website, including:

- Completely free
- Up to 200 attendees (including the presenter)
- Unlimited meetings
- Video conferencing (maximum length is up to 3 hours)
- Screen sharing
- Application sharing
- Recording
- Webinar ticketing
- VoIP
- Conference calling
- Public profile
- Social media integration
- Text chat
- Polling
- Invitations
- Surveys
- Reporting
- No required downloads

The features in AnyMeeting support most key common requirements asked by participants who expected to use the VCCS. As AnyMeeting is ad-supported, it is not advertising free for attendees. To some extent, attendees will be disturbed by the advertising on the top of the screen. Additionally, iPad and iPhone do not support Adobe Flash that AnyMeeting requires, therefore, accessing an AnyMeeting session via iPad or iPhone is not supported.

AnyMeeting has its potential for supporting training and tutoring with a small group of attendees according to the key requirements summarised in Table 2. Although AnyMeeting is lack of whiteboard and file transferring functionalities, its screen and application sharing features will make the interaction between the presenter and attendees very easy. As AnyMeeting does not support breakout rooms, it may limit people who want to engage attendees through group works or group discussions. The pros and cons of AnyMeeting in the use of training and tutoring are listed in Table 7.

As AnyMeeting supports a large number of participants in a session synchronously, it may be suitable for the participants who want to use the VCCS for an online lecture presentation (details see Table 8).

AnyMeeting is useful for participants who want to use the VCCS for virtual meetings. Users can easily send email invitations and to display PowerPoint or other documents by Screen

Sharing. Users can record the meeting and review the meeting reports too. However, it will be inconvenient for users who want to access a virtual meeting through iOS devices. The features are shown in Table 9.

AnyMeeting has features such as polling and survey, promoting activates on Twitter and Facebook, and the choice of Audio broadcasting, which give both students and educators many flexible options. It allows the presenter to publish URL links in the presentation, which to some degree provides an alternative way for users to access external recourses and learning materials in LC. Its weakness such as no supporting for multiple languages and not allow users to customise the font size and colour of their chat messaging to some extent will dissatisfy the user's experience. These features have been displayed in Table 10 and Table 11.

## **TeamViewer**

<http://www.teamviewer.com/en/index.aspx>

TeamViewer is an intuitive, fast and secure application for remote control, desktop sharing, file transfer and online meetings with audio, video and screen sharing technologies. The German based TeamViewer GmbH was founded in 2005 and is fully focused on development and distribution of high-end solutions for online collaboration and communication. It is free for non-commercial and educational use. It is very suitable for those who are looking for a tool that can help them to facilitate interactive presentations or distance user support.

TeamViewer Version 7 has been tested. To run TeamViewer, it needs the presenter to download and install the software. The presenter runs it as stand-alone application directly from their computer. The Participants can use a web-based version to attend a session.

The features of TeamViewer have been outlined on their website, including:

- Free for non-commercial use
- Up to 25 attendees (including the presenter)
- Ad-hoc remote control
- Integrated screenshot function
- Invitations
- Plan meetings
- Apps for iPhone, iPad and Android
- Text chat
- VoIP
- Video conferencing
- File box for sharing files
- Recording
- Convert your recorded sessions into AVI format and edit the video at will
- Screen sharing
- Have multiple concurrent sessions from your computer to different partners
- Information exchange is encrypted and secure

TeamViewer support most key common requirements asked by participants who expected to use the VCCS. It requires software installation, but it is not difficult.

TeamViewer allows the presenter to host a video meeting showing what is on their screen to a maximum of 25 attendees. This will be useful for users who support training or tutorials for distance learners by using the features such as screen sharing, file transferring, remote control and screenshot. As TeamViewer does not support breakout rooms, polling and quizzes, it may limit the presenter to engage attendees through group works or quizzes. The pros and cons of TeamViewer can be viewed in Table 7.

TeamViewer supports maximum 25 attendees in both free version and a paid version. This is not suitable for the requirements for running lecture presentation to a large group of students.

TeamViewer has much strength in the use of virtual meetings. The user can start a meeting before adding any participants. The TeamViewer Apps support users to access a live session through mobile devices. Another reputable feature is the ability to drag and drop files into the program to share with another users. This feature would be useful in situations where the presenter needs to show a document and wants to add comments through voice or chat. More features such as file transferring, screen sharing and playing multimedia files allow participants to interact with each other in a very easy way. These features are listed in Table 9.

TeamViewer supports voice, video contact and instant meetings. It allows the presenter to share the whole computer screen or a number of selected windows with attendees. This could come in handy if one wanted to show an example of an upcoming assignment or demonstrate on his/her views on the aspects of the paper and want to receive feedback from students immediately. In addition, it allows users to save a whiteboard snapshot as a .png file and to save recordings to a local machine. Although TeamViewer does not support breakout rooms, its function of creating groups before a session could help to organise group activities. Table 10 and Table 11 present its pros and cons for supporting flexible learning environment.

## **Wiggio**

<http://wiggio.com/>

Wiggio is a free web-based collaboration toolkit that makes it easy to work in groups. The application is designed for any collaborative groups, such as clubs, committees, scouting troops, academic groups, political movements, non-profit organisations, social groups, sports teams and small businesses. Different from a normal social networking such as Facebook, Wiggio offers more professional collaboration and allows for more features. It originated a Cornell University class project and was founded in 2008.

The user does not need to download and install the program. However, to play a PowerPoint file in a Wiggio session, the user needs to install Presenter Windows Client to run the Present Client features. It also requires the latest Java for using the screen sharing function.

The features of Wiggio include:

- Free
- Host conference calls and virtual meetings
- Up to 10 participants in a virtual meeting
- Up to 50 participants in a conference call
- Unlimited storage within your folders and sub-folders within your group's main folder
- Share files
- Screen sharing
- Application sharing
- Create groups
- Calendar for scheduling events
- Sync Wiggio calendar to your Google, Yahoo!, Outlook or Apple calendar
- Recording of 2-minute voice or video messages and sending it by email, phone text and feed
- To-do list
- Text Chat
- Polling
- Invitations
- VoIP
- Group administrators have full permission controls
- All account information is located on a secured server behind a firewall

Wiggio is intuitive use and no real needing a lot of training. It is compatible with operating systems and the most popular web browsers. Its iPhone App is completely synchronised with the web app to make the on-the-go collaboration easy to use.

Wiggio provides opportunities for people to collaborate on a project or group work in an academic environment. The educators can easily organise training or tutorial sessions by using the functionalities such as to-do lists, shared calendars, sending text message reminders and storing one set of documents in a single repository. They can monitor group conference call, discussion board through posting, polling and chat rooms, sharing desktop and even run group brainstorming. Nevertheless, one limitation to Wiggio free version is that it will not record meetings even though there is a recording option in the function menu. In this respect, the features might not be adequate to the requirements for the training and tutorial use (see Table 7).

Wiggio supports maximum 10 attendees in a virtual meeting and maximum 50 attendees in a conferencing call. This is not suitable for the requirements for delivering lecture presentation to a large group of students.

As Wiggio was originally designed for group members to work collaboratively, its features such as share and edit files, schedule an event, manage a group calendar, polling, post links, chat online and send mass text, voice and email messages will benefit people who want to use the VCCS to host virtual meetings. As mentioned above, Wiggio has weakness of recording a

live session. However, one feature that stands out about Wiggio is that it has the function of recording a video/voice note and sending it by email, phone message and feed. Considering the use of virtual meeting, this gives users an alternative mechanism to communicate synchronously and asynchronously. Its specific features are listed in Table 9.

Wiggio has a bit of everything. It allows users to communicate in numerous ways and share files as well as opinions through polls. Its versatility offers users a flexible learning environment. For example, unlimited file storage, multiple languages option, screen sharing, attendees do not have to register Wiggio to attend a group event, group administrators can set exactly what non-administrators can and cannot do within a group. Just as any coin has two sides, the issue being discussed here is no exception. Functionalities, such as not allow users to customise message font, no recording in a live session and 2-minutes limitation for voice/video messages, and operating outside of VLE systems are downsides of the application. A comparison between the key features of Wiggio, TeamViewer, and AnyMeeting in terms of enhancing flexible learning experience and teaching approaches can be seen in Table 10 and Table 11.

**Table 7 A comparison of key features in AnyMeeting, TeamViewer and Wiggio for the use of training/tutoring**

Feature categories	Required features	AnyMeeting		TeamViewer		Wiggio	
		Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support 1- 20 attendees at the same time	Y (Up to 200 attendees)		Y (Up to 25 attendees)		Y (Up to 10 attendees in a Virtual Meeting and up to 50 in a conference call)	
Communication	Control of sharing video/ webcam by individual	Y		Y		Y	
	Icons of capabilities by attendees (e.g., microphone, webcam)	Y		Y		Y	
	Alerts of activities (e.g., new message, users joined, left, notifications)	Y	Attendees cannot control turn audio alerts on/off	Y		Y	
	Email attendees and guests to a scheduled session	Y		Y		Y	
	Textual public messaging	Y		Y		Y	
	Textual private messaging	Y		Y		Y	
	Audio	Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Y			N	Y	
	Save chat history or record it in a session	Y (In the chat report)		Y		Y (In the video meeting report)	
Customise chat text (font, size, colour) by individual		N		N		N	
File transferring	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)		N	Y		Y	
	Download files		N	Y		Y	
Capture/ record/ playback	Sessions recording	Y		Y			Have the feature on the menu, but is disabled
	View and edit recorded sessions	Y		Y			
	Control access to recorded sessions	Y	Files cannot be	Y			N

			exported				
	Session playback	Y		Y			N
Integration with internal/external tools and services	Support mobile devices access		iPad and iPhone do not support Adobe Flash so it is unable to use AnyMeeting	Y		Y	
	Web tour	Y			N		N
Application/ Screen sharing	Application sharing	Y		Y		Y	
	Screen sharing or Remote control	Y		Y		Y	
	Allow attendees to share their screen	Y		Y		Y	
Live video & Audio streaming	Support various types of multimedia files	Y (.rm, .flv files)	Attendees cannot view/hear .mp4, .avi, .wmv, .mov files playing	Y		Y (.flv file)	
	Resize videos and control full screen video by individual	Y		Y		Y	
	Audio/video wizard or help	Y		Y		Y	
Feedback/polling	Polling	Y	Attendees cannot see the on-the-fly results		N	Y	
Quiz/Survey	Quizzes	Y			N	Y	
Participant list & right management	Allow multiple people have moderator roles	Y		Y		Y	
Breakout rooms	Breakout rooms		N		N		N
Whiteboard	Multiple participants use it simultaneously		N	Y		Y	
	Whiteboard snapshot						
Pricing	Free version or low cost	Y (Free)		Y (Free, v7)		Y (Free)	

**NB:** Y – Yes; N – No; V- Version

**Table 8 The key features in AnyMeeting for the use of lecture presentation**

Feature categories	Required VCCS features	AnyMeeting	
		Pros	Cons
Supported communication channel	Support at least 50 attendees at the same time	Y (up to 200 attendees)	
Communication	Icons of capabilities by attendees (e.g., microphone, webcam)	Y	
	Alerts of activities (e.g., new message, users joined, left, notifications)	Y	
	Email attendees and guests to a scheduled session	Y	
	Textual public messaging	Y	
	Textual private messaging	Y	
	Audio	Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing)	Y	
	Save chat history or record it in a session	Y (in the chat report)	
File transfer	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)		N
Feedback/polling	Polling	Y	Attendees cannot see the on-the-fly results
Quiz/Survey	Quiz or survey	Y	
Capture/record/playback	Sessions recording	Y	
	View and edit recorded sessions	Y	
	Control access to recorded sessions	Y	Files cannot be exported
	Session playback	Y	
Integration with internal/external tools and services	Support mobile devices access		iPad and iPhone do not support Adobe Flash so it is unable to use AnyMeeting
Application/Screen sharing	Application sharing	Y	
Live video & Audio streaming	Support various types of multimedia files	Y (.rm, .flv files)	Attendees cannot view/hear .mp4, .avi, .wmv, .mov files playing
	Resize videos and screen by individual	Y	
	Audio/video wizard or help	Y	
Participant list & right management	Allow multiple people have presenter or moderator roles	Y	

**NB:** Y – Yes; N - No



**Table 9 A comparison of key features in AnyMeeting, TeamViewer and Wiggio for the use of virtual meetings**

Feature categories	Required VCCS features	AnyMeeting		TeamViewer		Wiggio	
		Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support a small group of attendees at the same time (e.g., 20 attendees)	Y (Up to 200 attendees)		Y (Up to 25 attendees)		Y (Up to 10 attendees in a Virtual Meeting and up to 50 in a conference call)	
Communication	Audio	Y		Y		Y	
	Video	Y		Y		Y	
	Textual public messaging	Y		Y		Y	
	Textual private messaging	Y		Y		Y	
	Email attendees and guests to a scheduled meeting	Y		Y		Y	
Whiteboard	Whiteboard		N	Y		Y	
File transfer	Upload files (e.g., presentation slides, multimedia files) and play files		N	Y		Y	
Integration with internal/external tools and services	Support mobile devices access		iPad and iPhone do not support Adobe Flash so it is unable to use AnyMeeting	Y		Y	
Application/Screen sharing	Screen sharing	Y		Y		Y	
	Application sharing	Y		Y		Y	
Participant list & right management	Allow multiple people have presenter or moderator roles	Y		Y		Y	
Capture/record/playback	Recording meetings	Y		Y			Have the feature on the menu, but is disabled
	Playback recorded meetings	Y		Y			N
Live video & Audio streaming	Support various types of multimedia files	Y (.rm, .flv files)	Attendees cannot view/hear .mp4, .avi, .wmv, .mov files playing	Y		Y (.flv file)	

	Resize videos and screen by individual	Y		Y		Y	
	Audio/video wizard or help	Y		Y		Y	

**NB:** Y – Yes; N - No

**Table 10 A comparison of key features in AnyMeeting, TeamViewer and Wiggio for supporting flexible learning experience**

Feature categories	Required VCCS features	AnyMeeting		TeamViewer		Wiggio	
		Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support a small group of attendees at the same time	Y (Up to 200 attendees)		Y (Up to 25 attendees)		Y (Up to 10 attendees in a Virtual Meeting and up to 50 in a conference call)	
	Support a large group of attendees at the same time				N		
Integration with internal/ external tools and services	Support different operating systems	Y		Y		Y	
	Runs on different web browsers	Y		Y		Y	
	Support mobile devices access		iPad and iPhone do not support Adobe Flash so it is unable to use AnyMeeting	Y		Y	
	Provide a way of integrating VCCS into LC	Y (Use Web Tour)			N		N
Communication	VoIP	Y		Y		Y	
	Textual public messaging	Y		Y		Y	
	Textual private messaging	Y		Y		Y	
	Audio	Y		Y		Y	
	Video/webcam	Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Y			N	Y	
	Customise chat text (font, size, colour)		N		N		N
Application/Screen sharing	Screen sharing	Y		Y		Y	
	Application sharing	Y		Y		Y	
Whiteboard	Using whiteboard		N	Y		Y	
File transfer	Download learning resources		N	Y		Y	
Live video & Audio streaming	Support various types of multimedia files	Y (.rm, .flv files)	Attendees cannot view/hear .mp4, .avi, .wmv, .mov files playing	Y		Y (.flv file)	
	Resize videos and control full screen video	Y		Y		Y	

Breakout rooms	Breakout rooms		N		N		N
Service/support	Support multiple languages		N	Y		Y	
Feedback/polling	Polling	Y	Attendees cannot see the on-the-fly results		N	Y	
Capture/record/playback	Access to recorded sessions	Y	Files cannot be exported	Y			N
	Session playback	Y		Y			N

**NB:** Y – Yes; N - No

**Table 11 A comparison of key features in AnyMeeting, TeamViewer and Wiggiio for supporting flexible teaching approaches**

Feature categories	Required VCCS features	AnyMeeting		TeamViewer		Wiggiio	
		Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support 50 or more attendees at the same time	Y (Up to 200 attendees)			N	Y (Up to 10 attendees in a Virtual Meeting and up to 50 in a conference call)	
	Support 1-20 attendees at the same time			Y (Up to 25 attendees)			
Communication	Email attendees and guests to a scheduled session	Y		Y		Y	
	Textual public messaging	Y		Y		Y	
	Textual private messaging	Y		Y		Y	
	Audio	Y		Y		Y	
	Video/webcam	Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Y			N	Y	
Service/support	Review and edit a scheduled session	Y		Y		Y	
Live video & Audio streaming	Support presentation files and images (e.g., ppt, pdf, jpg, html)						
	Support various types of multimedia files (e.g., swf, qt, wmv, mpg, mp3, m4v)	Y (.rm, .flv files)	Attendees cannot view/hear .mp4, .avi, .wmv, .mov files playing	Y		Y (.flv file)	
	Resize videos and control full screen video	Y		Y		Y	
Participant list & right management	Allow multiple people have presenter or moderator roles	Y		Y		Y	
File transfer	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)		N	Y		Y	
	Allow attendees to upload files		N	Y		Y	
	Allow attendees to download files		N	Y		Y	
Whiteboard	Allow attendees to drawing on the whiteboard		N	Y		Y	
Application/Screen sharing	Sharing screen and applications	Y		Y		Y	
	Allow attendees to share screen or applications	Y		Y		Y	
Breakout rooms	Breakout rooms		N		N		N

Feedback/polling	Polling	Y	Attendees cannot see the on-the-fly results		N	Y	
Quiz/survey	Quizzes	Y			N	Y	
Capture/record/playback	Sessions recording	Y		Y			Have the feature on the menu, but is disabled
	Review and edit a recorded session	Y		Y			N
	Control access to a recorded session	Y	Files cannot be exported	Y			N
Usability	User tracking	Y			N		N

**NB:** Y – Yes; N - No

## Toolset 2 – Free trial version software

There were 17 VCCS products that provide a free trial version and have been reviewed by the project manager (see Appendix 5, in blue texts). To some degree, 12 tools were not good enough in regard to the requirements from users. A brief comparison of the 12 VCCS products can be viewed in Appendix 7. Five tools (Adobe Connect, Blackboard Collaborate, Microsoft Lync Online, omNovia and WizIQ) provide the most key features concerning a specific required use. The application details will be discussed in this section.

### Adobe Connect

<http://www.adobe.com/products/adobeconnect.edu.html>

Adobe Connect is a web conferencing platform for web meetings, e-learning and webinars. Adobe Connect offers a high degree of customisation, and allows users to change the layout of the application based on their specific needs. Adobe Connect was formerly part of the Adobe Acrobat family and has changed names several times. The product can be traced back to 2003. It offers a 30-day free trial. The trial version Adobe Connect 8 was reviewed and the latest version is 9. It is a good choice for professional use.

Adobe Connect relies on web-standard Adobe Flash, so no downloads are required to join meetings. Adobe Flash Player software is already installed on virtually all Internet-connected computers.

The features of Adobe Connect include:

- Up to 1,500 attendees per meeting
- High-quality video conferencing
- Each host (licenses holder) can run unlimited meetings
- Audio and video controls
- Screen sharing
- VoIP
- Social media integration (e.g., Twitter feeds, searching and playing videos in YouTube)
- Text chat
- Whiteboard
- Polling
- Note taking
- Breakout rooms
- Question and answers area
- Invitations
- File transferring
- Recording and editing for reuse
- Store rich media content and metadata (e.g., PowerPoint presentations, .flv, PDF, .swf, .mp4 and more)

- Provides leverage templates (training, meeting, and event) for users regarding to a specific type of learning activity
- Hosts can manage a full range of participant meeting privileges in real-time, including such aspects as roles, sharing, chatting, and submitting questions
- Integrate with existing video teleconferencing systems supporting SIP/H.264 (Tandberg, Polycom, PictureTel, others), and bring in-room video streams directly into web meetings
- Complete mobile collaboration, including iOS, Android, Blackberry PlayBook, iPad and iPhone
- Integration solutions for both Blackboard and Moodle LMS

The weakness of Adobe Connect includes:

- The user interface can be convoluted at times comparing other VCCS. For example, to setup a simple meeting, the user needs to fill out a 3-page multi-field form.
- It allows users to record meetings, but retrieving the recordings is not straightforward. The recording is not immediately viewable offline.
- It does not allow users to export polling results.
- Each host can run many meetings but not concurrently.
- It does not offer an option to participate in meetings using a telephone. This will be inconvenient for remote users, who may travel and not have immediate access to an Internet connection.

Adobe Connect can be purchased as a hosted service by small businesses and individuals. Educational institutions have a choice of either:

- Hosted services on annual subscription basis;
- On-premise installations comprising Perpetual license plus annual maintenance and support;
- Managed services comprising perpetual license plus annual maintenance and support and service fee.

A comparison of the service pricing has been presented in Table 17.

Adobe Connect is compatible with Windows 7, Windows Vista, Windows XP, Mac OS, Linux, Solaris and Mobile devices. Furthermore, it performs well on the most popular web browsers (e.g., Firefox 10, Google Chrome 12, and IE 8). Its collaboration features, such as whiteboard, transferring files, are easy to use and helpful.

Adobe Connect provides powerful presentation features. For example, using drag and drop functionality to open files when prepare a learning content; scheduling an activity; using integrated address books when arrange a training session; adopting whiteboard, private chat, and layout customisation with multiple presenters before and during a session, will be of great benefit to people who want to apply the VCCS to manage online trainings or tutorials. The pros and cons of Adobe Connect in this use can be viewed in Table 12.



Adobe Connect supports large number of concurrent users and enables participants to provide video feeds into the online meeting. This feature is very useful for making online lecture presentations. Furthermore, it contains a special presenter-only area that allows sharing of content that cannot be seen by other participants. This will help to run a session involving multiple presenters and moderators. Its features in relation to the requirements for supporting online lecture presentation are listed in Table 13.

Adobe Connect provides a variety of features that enable rich, highly collaborative interactions, such as simple 1:1 ad hoc document reviews, rich media presentations to hundreds of attendees, planning sessions with partners, and create multiple breakout rooms, each with its own private VoIP or telephone conference call. This shows that it has a potential usage to support virtual meetings. The details of its features are in the comparison Table 14.

Adobe Connect is a strong contender in the VCCS products. It offers most features the user needs, which provides the students flexible learning experience and provides the educators flexible approaches. For example, Adobe Connect module provides the officially sponsored integration method for Blackboard and Moodle. It is designed to simplify the use of synchronous events within a LMS. So as long as the user is logged into the LMS, they will never have to enter in user credentials to get access to an Adobe Connect session. In addition, its user interface is completely navigable by keyboard, is friendly to screen readers, and supports hot keys for important functionality. It allows easily schedule, start, and join Adobe Connect meetings from the user's Microsoft Outlook or IBM Lotus Notes email and calendar. Among the listed applications here, Adobe Connect is the only application that allows administrators to edit both session settings and a recorded session. Without doubt it offers many customisable features for users. Form Table 15 and Table 16, you can see the pros and cons of Adobe Connect to provide flexibilities for students and educators.

## **Blackboard Collaborate**

<http://www.blackboard.com/platforms/collaborate/overview.aspx>

In July 2010, Blackboard Inc. acquired synchronous and collaboration technology leaders Elluminate and Wimba. They rebranded it as Blackboard Collaborate Web Conferencing and formed a SaaS platform that is easy to deploy, secure, and low cost to maintain, with availability that ensures teaching and learning can happen without interruption. It offers a 30-day free trial and the latest version is 12. The version 11 was tested. Blackboard Collaborate offers features to fit large institutions as well as smaller customers. It is suitable for organisations that want to flexibly hold both large webinars and small collaborations with a fixed annual cost.

Running a Blackboard Collaborate room needs the user have a current version of Java installed. The building block makes it easy to install and integrate into the current university LMS.

The key features of Blackboard Collaborate include:

- Up to 400 attendees (maximum 25 attendees per meeting with the trial version)
- High-quality video conferencing
- Consistent live video with follow the speaker, multipoint
- Text chat
- Web tour
- VoIP
- Audio and video controls
- Live webcam
- Whiteboard
- Breakout rooms
- Invitations
- Screen sharing
- Application sharing
- Recording and editing for reuse
- File transferring
- Note taking
- Polling
- Quiz and survey
- Extensible architecture to allow future addition of new tools (e.g., mathematical symbols, scientific notation)
- Streamlined, easy deployment of multiple locations and choice of language
- Mobile collaboration, including iOS, Android, Blackberry PlayBook, iPad and iPhone
- Reports and track who views recordings
- Integration solutions for both Blackboard and Moodle LMS
- Integrate with other asynchronous LMS (e.g., Pearson LearningStudio, Sakai, Desire2Learn)

The weakness of Blackboard Collaborate includes:

- The moderator cannot control the playing of the audio/video on each participant's computer, e.g. the file will only start playing if, as with YouTube, files start playing automatically. If the moderator pauses the playing on their own computer, it will not pause on the participant's computer.
- As it allows the user to place a URL address of a web-page containing audio or video in chat or whiteboard, it is difficult for the moderator to sync the viewing of such source with their presentation and could distract participants from the main trust of the session.

A comparison of the service pricing has been presented in Table 17.

Blackboard Collaborate runs on Windows 7, Windows XP, Windows Vista, Mac OS 10.5, Mac OS 10.6, and Linux Ubuntu 10.04. It supports IE8, IE9, Safari 5.0, Firefox latest stable release and Google Chrome stable channel. It provides the key common required features, such as easy to use and reliable.

Blackboard Collaborate has enhanced features for a richer, more interactive online teaching, learning and collaborative environment. As it is a part of Blackboard LMS products, its

seamless integration will be of great benefit for educators and learning activity support officers to manage online training courses or tutorials. It is very handy for LC users to invite enrolled students to attend online trainings and tutorials and it is convenient for attendees to access training materials or courses materials contained in LC. It provides many ways of encouraging interaction between the presenter and the attendees. For example, whiteboard, application sharing, polling, breakout rooms and indicating emotions like laughter, confusion, or agree will help the users to interact with each other in many ways. More detailed features that suggest Blackboard Collaborate is suitable for training and tutoring use can be seen in Table 12.

Blackboard Collaborate also has its place to support large group lecture presentations. For example, the presenter can schedule a session with LC Calendar and Grade Centre functions. It allows users to join a session from a mobile device such as iPhone or iPad. It facilitates session management with ability to easily toggle permissions for features, like audio and video, for all students with a single click. Considering a large number of attendees in an online lecture, the “raise hand” functionality will help to call the presenter’s attention if the attendee has a question or comment. Its recording function fits lecture capture requirements. All these features prove the advantages of Blackboard Collaborate (see Table 13).

Blackboard Collaborate offers features for virtual meetings too. As mentioned above, it allows integration with LC for administrative efficiencies and streamlined student access. It is no doubt that its key functionalities, such as file transfer, multiple moderators, sharing application and screens, chat and recording will make a virtual meeting easy to be arranged and conducted. The features are shown in Table 14.

It is hard to argue that Blackboard Collaborate has provided comprehensive features by combining the best functions of Elluminate and Wimba. To a large extent, it allows people to collaborate easily online in real-time. For example, Blackboard Collaborate allows the user to join a live session via LMS join link, email link, or calendar invite. Its mobile web conferencing is enabled for any LMS, including Blackboard Learn and Moodle integrations, allowing those who join a course via a mobile device to participate in a live web conference. This gives instructors more options to measure learning outcomes and effectiveness. In addition, all web conferencing sessions appear in the Blackboard Learn Calendar with a link to launch the session directly from the Calendar. This gives students and instructors quicker access to their sessions. Furthermore, it provides flexible approaches for instructors to present content in teaching, for instance display complex mathematical symbols or scientific notation on a whiteboard. These features are outlined in Table 15 and Table 16. Many case studies of using Blackboard Collaborate with different purposes can be found on the Blackboard official website.

### **Microsoft Lync Online**

<http://lync.microsoft.com/En-gb/launch/Pages/launch.aspx>

Microsoft Lync Online is a next-generation cloud communications service that connects people in new ways, anytime, from virtually anywhere by using presence, instant messaging, PC-to-PC calling, and rich online meetings with audio, video, and web conferencing. It is one of several cloud services offered by Microsoft Office 365 for enterprises. It is useful for users to interact with colleagues, external guests and partners in a collaborative, engaging and effective way. The application was formerly called Microsoft Office Communicator (version 2007). The latest version is Microsoft Lync 2010, version 4.0. It provides a free 180-day trial version of Lync server 2010.

To access and use the Microsoft Lync Online, the user needs to install Microsoft Lync 2010, the desktop client for Lync Online. Installation of a Microsoft ActiveX control is required for using the desktop or application sharing function.

The features of Microsoft Lync Online include:

- Up to 250 contacts to the Lync contact list
- Up to 250 people to collaborate at a time
- Instant messaging
- Connections with several public IM networks such as MSN/Windows Live, Yahoo!, and AOL
- Presence (status e.g., Available, Away, Do Not Disturb, Offline)
- Search the company's address book to find other users
- File transferring
- Audio conferencing
- Video conferencing
- Live webcams
- VoIP
- Desktop sharing
- Application sharing
- Whiteboard
- Recording and editing for reuse
- Annotations
- Invitations
- Polling
- Remote control
- Mobile collaboration, including Android, iPad, iPhone, Windows Phone, and Nokia mobile devices
- Multiple choices of language

The weakness of Microsoft Lync Online includes:

- Microsoft is trying to be all things to all users, thus, setting up Lync Online is complex to understand (e.g., see Microsoft Lync, Client Comparison Tables, <http://technet.microsoft.com/en-us/library/gg425836.aspx>) comparing to other web-based applications such as AnyMeeting and Adobe Connect.
- Microsoft Office 365 does not support client development in a customer organisation. This means it needs the user to work with IT partners if they want to develop the Lync 2010 client.

- Although Microsoft Lync supports mobile devices, not every type of mobile device has full features, for instance, iPhone, iPad and Android do not have calendar integration; Android does not have Meeting Pane integration.
- Microsoft Lync Online has not provided a solution for integrating into Blackboard and Moodle. Some Microsoft partners provide solutions for the Microsoft Lync platform to integrate into a LMS (e.g., Virtual TEK, SmartClass), however, the user needs to pay extra cost for the service.
- Microsoft Lync Web App does not include integrated audio and video.
- Microsoft Lync Web App does not support uploading files that are created by using Microsoft PowerPoint presentation graphics program.

Organisation can subscribe Microsoft Lync Online as a standalone service from Microsoft Office 365 or as part of an Office 365 for enterprises suite that includes Lync Online, Microsoft Exchange Online, Microsoft SharePoint, Microsoft Office Professional Plus, and Microsoft Office Web Apps. A comparison of the service pricing has been presented in Table 17.

Microsoft Lync Online runs on Windows 7, Windows XP, Windows Vista, Mac OS 10.5, and Mac OS 10.6. It supports IE7, Firefox 3, Safari 4 and Google Chrome 6, and their later versions. It provides the key common required features, such as reliable and easily works with Microsoft Office products.

Table 12 presents features of Microsoft Lync Online in the use of supporting online training and tutoring. With Microsoft Office 356, it enables users to access many Lync online features directly. For example, the user can share an open document in Word 2010, Excel 2010, or PowerPoint 2010 by sending a copy or starting a sharing session with one or more contacts. Using Microsoft Lync Web App communications software, it allows attendees to join a Microsoft Lync online meeting even if they do not have a Microsoft Lync account and have not installed the Lync 2010 client software on their computers. Not like Skype, an IM tool, the improved features in Microsoft Lync Online provide alternative ways for people to run a training or tutorial session easily. For example, it supports whiteboard, saving whiteboard snapshot, file transferring, chat, polling and recording; it even allows the user to set up a local path to save recorded sessions in his/her own computer.

With regard to a complete solution for web conferencing and delivering exceptional experiences for e-learning, Microsoft Lync Online is not as good as Blackboard Collaborate and Adobe Connect. In the use of supporting lecture presentation, it has the functionality of playing presentations, allowing multiple moderators, recording and exporting recordings. However, to certain degree, the lack of features such as web tour (publishing URLs and allowing users to access websites), configure user roles and permissions, extensible function for future addition tools (e.g. mathematical symbols, scientific notation), planning tools to allow moderators to prepare and schedule course sessions will limit users to deliver an online lecture to a large group of students. A comparison of its features has been listed in Table 13.

Basically, Microsoft Lync Online is designed for people in an organisation to work together collaboratively and effectively, such as have a quick virtual conversation, immediately transfer files, or discuss via texts, audio or video without having to be at the same place. Clearly, it has advantages to support virtual communication. Similar to Lotus Sametime, Microsoft Lync Online allows a user to know whether others are available to communicate. They can search users to schedule a meeting with them by checking their available dates and time. Many functionalities, such as inviting external users, virtual webcam, screen sharing, whiteboard, IM and playing multiple files well support its use in virtual meetings (more details see Table 14).

It is hardly any doubt that based on the fact that most people in workplace are using a Microsoft product (e.g., Microsoft Office, Microsoft Project and Microsoft SharePoint), Microsoft Lync Online has its strength at an organisational level of engaging people to work together easily and collaboratively. It is the best resource for administrative purposes. For example, users can click-to-communicate from Microsoft Office Outlook, communicate with Windows Live Messenger contacts, or collaborate with SharePoint sites. However, Microsoft Lync Online was not designed for classroom and academic support collaboration and its integration solutions for e-learning are all offered by its partners. This limits its extensibility and flexibility to handle current and new e-learning requirements (e.g., schedule a virtual session through LC; invite all enrolled students to an online introduction session; access learning materials in LC during a virtual session). The features of Microsoft Lync Online for enhancing students' flexible learning experience and providing flexible teaching approaches can be seen in Table 15 and Table 16.

### **omNovia**

<https://www.omnovia.com/>

OmNovia is a simple and complete web-based conferencing tool. It is designed for online meetings, high-quality webinars, engaging online trainings and live event webcasting solutions for small business meetings and large-scale enterprise conferences. The company was founded in 2004 in Houston, Texas, USA with the clear vision of bringing the power of high quality online communication to every business. The latest version is 3. It offers a free 20-day trial version.

As omNovia is a browser-based application, attendees can join meetings simply by clicking a URL without installing any software. Similarly to the other recommended web-based applications, it uses Adobe Flash technology as the underlying platform for operation, which aims to be largely unaffected by the choice of operating system or browser for each user. The user needs to have a fairly recent version of the Adobe Flash Player. OmNovia Web Conference Projector application is free and must be installed in order to use full projection inside application or conferencing room.

The key features of omNovia include:

- Up to 5,000 attendees per web conference
- Up to 400 callers in a phone conference
- Text chat
- Whiteboard
- Desktop sharing
- Application sharing
- Polling
- Remote control
- Invitations
- File transferring
- Live notes
- Recording (5 hours limits)
- Announcements
- VoIP
- Audio and video controls
- High-quality video conferencing
- Question and answers manager
- A world map showing the approximate location of all participants
- Countdown timer
- Reports
- Mobile collaboration on both iOS (iPad and iPhone) and Android devices
- Support any language and character set
- 10 different languages interface options
- Highest level of security (128-bit SSL encryption)

The weaknesses of omNovia include:

- Presenters who want to use screen sharing or session recording must be on a Windows operating system as those functions use locally installed EXE programs. Mac OS users can attend conferences, but not host a conference.
- Although it provides APIs, there are no available integration solutions in conjunction with LMS such as Blackboard and Moodle.

A comparison of the service pricing is displayed in Table 17.

OmNovia runs in all major browsers (Microsoft Internet Explorer, Firefox, Opera, Google Chrome, Netscape, and Safari) on Windows 7, Vista, XP, Mac OS, and Linux. Accessing an online room is as simple as accessing any web page. Its controls are simple and mostly intuitive. Its redundant and load-balanced architecture ensures continuity and reliability during a webinar or web conference.

OmNovia offers a variety of communication solutions. Moderators can control how many participants are able to interact in any session and show their audience any application opened on their PC desktops in real-time. Sessions can be partially or entirely automated for consistency, and they can be recorded and distributed for participants who either miss them or want to review them later. OmNovia also supports participants in multiple locations to choose a language of the user interface. However, comparing to other listed applications, the

drawbacks such as no breakout rooms and Mac OS users cannot host a session will limit its use. The features of omNovia in the use of supporting online training and tutoring are presented in Table 12.

OmNovia offers most key features for the requirements of using the VCCS for online lecture presentation. It does not support functionalities such as whiteboard, instant polling and sharing screen, but has ability to support up to 5,000 participants synchronously in a web conference and record a up to 5 hours session. Additionally, as soon as a session is terminated, a full report on attendance including contact information and the duration of attendance, along with transcripts of messages, results of Instant Polls etc. become available in the Reports section of the "Admin Page". Reports can be downloaded in Microsoft Excel format. This will help the lecturers who want to manage online lectures involving a large group of students. A comparison of its features has been listed in Table 13.

The features in omNovia will be of benefit for people who want to use the VCCS to support virtual meetings (see Table 14). However, again, comparing to Blackboard Collaborate and Microsoft Lync Online, omNovia does not allow Mac OS users to host a conference. They will feel inconvenient if they want to schedule a virtual meeting.

OmNovia has many good features that could be used to enhance students' flexible learning experience and provide educators additional ways (see Table 15 and Table 16). For example, it supports mobile devices to access a live session. It allows users to customise a room interface. It integrates high quality audio with echo cancellation and HD quality video with 30 frames-per-second. Moreover, its unique Recast technology allows users to replay events exactly the way they happened in a fully interactive environment. Unlike traditional screen recording that generates large movie files, Recast is a re-enactment of the original presentation and offers viewers the same level of interactivity as the original one. Attendees may type in chat, take polls or download files from the Documents folder as if the event was live. Recast enables on-demand and group mode replays.

## **WizIQ**

<http://www.wiziq.com>

WizIQ is a virtual classroom application focusing firmly on the education sector. It extends the traditional virtual classroom platform by adding in social networking features that allow users to join groups based on common interests. It enables synchronous distance learning with tools like real-time virtual classrooms with multi-way audio, up to 6 live video streams, integrated chat, interactive whiteboards, application sharing, file transfer, breakout rooms, and more. The application was launched in 2007. The most recent version was released in January 2012. Users can join in and try it free for 30-day.

WizIQ is a software-as-a-service platform so there is no downloadable application that the user needs to run behind their firewall. It requires the latest Adobe Flash Player and the latest Java.



The features of WizIQ include:

- Up to 500 students per class
- Up to 6 simultaneous live video streams
- Up to 300 minutes per session
- Audio and video controls
- Text chat
- Whiteboard
- Invitations
- Screen sharing
- Application sharing
- Recording
- File transferring
- Tools to filter and search attendees
- Polling
- Breakout rooms
- Class status and attendance report
- VoIP
- Social media integration (e.g., Twitter feeds, searching and playing videos in YouTube)
- Mobile collaboration, including Android, iPad and iPhone
- WizIQ APIs and plug-ins for integrating with an existing website or LMS (e.g., Moodle and Blackboard)

The drawbacks of WizIQ include:

- Attendees cannot see the polling results.
- The moderator cannot export polling results by one single click.
- In a virtual classroom, the user is unable to share applications.

WizIQ provides virtual classroom plans for individual teachers, online tutors, professional trainers, and collage instructors. It also provides plans for training division, online tutoring companies, and academy and universities. The pricing of the plans can be seen in Table 17.

WizIQ runs on the most common Windows operating systems (Mac OS, and Linux Ubuntu) and web browsers (IE 6 and above, Opera 8 and above, Netscape, Google Chrome, Firefox 3.5 above and Safari 4.0 if need screen sharing functionality). As addressed on their website, it offers a very simple interface that allows the users focus on their teaching rather than the technology.

WizIQ has called educators' attraction because educators are always on the lookout for easy-to-use tools that promote synchronous interaction coupled with information dissemination within a network, especially one that lends itself to a formal venue, such as a classroom. It provides many features to make learning and teaching easy, effective and enjoyable. Online training or tutoring can be easily delivered through audio, video, chat, whiteboard and downloadable recordings of each session. For example, the presenter can schedule online classes and upload content (e.g., documents, presentation, video and audio file, excel etc.) before the class or on-the-fly during the class. Although it does not support quizzes and

survey, it has an online test function which allows the presenter to create a test and upload it into a scheduled session. Similar to Adobe Connect, WizIQ provides the feature that allows users to customise a URL for a session. This feature will be handy for people who run training courses in a specific educational area. The features of WizIQ in the use of training and tutoring can be seen in Table 12.

It is possible to use WizIQ to support online lecture presentations. It allows up to 500 attendees synchronously in a virtual classroom. By using the WizIQ content repository, it allows the lecturer to organise and conduct presentations using slides created in PowerPoint, Mac Keynote, or other presentation software easily. Within whiteboard, its ability of using mathematics symbols is as good as Blackboard Collaborate. In Table 13, a comparison of WizIQ's features with other listed applications is shown. It seems that the most needed feature in WizIQ would be allowing participants to see a real-time polling result.

In Table 14, it presents the WizIQ's features in the use of virtual meetings. It is clear that WizIQ offers many supportive features that fit the requirements for this use, for instance, make online meetings more interactive by pushing URLs, forms, cookies, scripts, and other data directly to session attendees, so they can participate in demonstrations and other activities in real-time. It allows the moderator to pass controls to attendees so they can share their desktops or annotate the moderator's. It supports the presenter to play audio or video files in the Windows Media Player easily. The one big drawback is that it does not support application sharing, but the provider stated that it is under development.

WizIQ Virtual Classroom has been commented as an innovative and pioneering initiative to stimulate an enriching learning experience. One typical example is that it supports a multiple language channel (not limit on one language, mentioned on their website), which gives international students more learning opportunities. It also provides flexible approaches for instructors to present content in teaching, for instance, the ability of displaying complex mathematical symbols on a whiteboard, customising interface, full control of function permissions for a participant, and using breakout rooms to organise group discussions. In addition, as it has offered solutions for integrating with some LMSs (e.g., Blackboard and Moodle), it saves time for support staff to work on developing an integration solution for the existing LMS. Meanwhile, the users will experience less transitions or distractions when they switch between different systems like joining an online teaching session using WizIQ and accessing module materials in LC. The details of its features are displayed in Table 15 and Table 16.

**Table 12 A comparison of key features in the five applications for the use of training/tutoring**

Feature categories	Required features	Adobe Connect		Blackboard Collaborate		Microsoft Lync Online		omNovia		WizIQ	
		Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support 1- 20 attendees at the same time	Y		Y		Y		Y		Y	
Communication	Control of sharing video/ webcam by individual	Y		Y		Y		Y		Y	
	Icons of capabilities by attendees (e.g., microphone, webcam)	Y		Y		Y		Y		Y	
	Alerts of activities (e.g., new message, users joined, left, notifications)	Y		Y		Y		Y		Y	
	Email attendees and guests to a scheduled session	Y		Y		Y		Y		Y	
	Textual public messaging	Y		Y		Y		Y		Y	
	Textual private messaging	Y		Y		Y		Y		Y	Not between attendees
	Audio	Y		Y		Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Y		Y		Y		Y		Y	
	Save chat history or record it in a session	Y		Y		Y		Y		Y	
	Customise chat text (font, size, colour) by individual	Y	Not the font type	Y	Not the font colour	Y		Y		Y	
File transferring	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)	Y		Y		Y		Y		Y	
	Download files	Y		Y		Y		Y			N
Capture/ record/ playback	Sessions recording	Y		Y		Y		Y	Not Mac user	Y	
	View and edit recorded sessions	Y		Y	Not editing	Y	Not editing	Y	Not editing	Y	Editing under way
	Control access to recorded sessions	Y		Y		Y		Y		Y	
	Session playback	Y		Y		Y		Y		Y	
Integration with	Support mobile devices access	Y		Y		Y		Y		Y	

internal/external tools and services	Web tour	Y		Y			N		N, may through chat box		N, may through chat box
Application/ Screen sharing	Application sharing	Y		Y		Y		Y			N
	Screen sharing or Remote control	Y		Y		Y		Y		Y	
	Allow attendees to share their screen	Y		Y		Y		Y		Y	
Live video & Audio streaming	Support various types of multimedia files	Y .flv, .swf, .mp3, .mp4, .f4v		Y .swf, .mpg, .mov, .qt, .mpg4, .m4v, .wmv, .mp3		Y .flv, .swf, .mp3, .mp4, .f4v		Y .mp4, .wmv, .mov, .avi		Y .mov, .avi, .mepg, .wmv, .mp3	
	Resize videos and control full screen video by individual	Y	Not resize video	Y		Y		Y		Y	Not resize videos
	Audio/video wizard or help	Y		Y		Y		Y		Y	
Feedback/polling	Polling	Y	Not exportable	Y		Y		Y		Y	Not exportable
Quiz/ Survey	Quizzes	Y	Not exportable	Y		Y			N		N
Participant list & right management	Allow multiple people have moderator roles	Y		Y		Y		Y		Y	
Breakout rooms	Breakout rooms	Y		Y			N		N	Y	
Whiteboard	Multiple participants use it simultaneously	Y		Y		Y		Y		Y	
	Whiteboard snapshot		N								
Pricing	Free version or low cost		N		N		N		N		N

**NB:** Y – Yes; N – No

**Table 13 A comparison of key features in the five applications for the use of lecture presentation**

Feature categories	Required VCCS features	Adobe Connect		Blackboard Collaborate		Microsoft Lync Online		omNovia		WiziQ	
		Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support at least 50 attendees at the same time	Y		Y		Y		Y		Y	
Communication	Icons of capabilities by attendees (e.g., microphone, webcam)	Y		Y		Y		Y		Y	
	Alerts of activities (e.g., new message, users joined, left, notifications)	Y		Y		Y		Y		Y	
	Email attendees and guests to a scheduled session	Y		Y		Y		Y		Y	
	Textual public messaging	Y		Y		Y		Y		Y	
	Textual private messaging	Y		Y		Y		Y		Y	Not between attendees
	Audio	Y		Y		Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing)	Y		Y		Y		Y		Y	
	Save chat history or record it in a session	Y		Y		Y		Y		Y	
File transfer	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)	Y		Y		Y		Y		Y	
Feedback/ polling	Polling	Y	Not exportable	Y		Y		Y		Y	Not exportable
Quiz/ Survey	Quiz or survey	Y	Not exportable	Y		Y			N		N
Capture/ record/ playback	Sessions recording	Y		Y		Y		Y	Not Mac user	Y	
	View and edit recorded sessions	Y		Y	Not editing	Y	Not editing	Y	Not editing	Y	Editing under way
	Control access to recorded sessions	Y		Y		Y		Y		Y	
	Session playback	Y		Y		Y		Y		Y	
Integration with internal/external tools	Support mobile devices access	Y		Y		Y		Y		Y	

and services											
Application/Screen sharing	Application sharing	Y		Y		Y		Y			N
Live video & Audio streaming	Support various types of multimedia files	Y .flv, .swf, .mp3, .mp4, .f4v		Y .swf, .mpg, .mov, .qt, .mpg4, .m4v, .wmv, .mp3		Y .flv, .swf, .mp3, .mp4, .f4v		Y .mp4, .wmv, .mov, .avi		Y .mov, .avi, .mepg, .wmv, .mp3	
	Resize videos and screen by individual	Y	Not resize video	Y		Y		Y		Y	Not resize videos
	Audio/video wizard or help	Y		Y		Y		Y		Y	
Participant list & right management	Allow multiple people have presenter or moderator roles	Y		Y		Y		Y		Y	

**NB:** Y – Yes; N - No

**Table 14 A comparison of key features in the five applications for the use of virtual meetings**

Feature categories	Required VCCS features	Adobe Connect		Blackboard Collaborate		Microsoft Lync Online		omNovia		WizIQ	
		Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support a small group of attendees at the same time (e.g., 20 attendees)	Y		Y		Y		Y		Y	
Communication	Audio	Y		Y		Y		Y		Y	
	Video	Y		Y		Y		Y		Y	
	Textual public messaging	Y		Y		Y		Y		Y	
	Textual private messaging	Y		Y		Y		Y		Y	Not between attendees
	Email attendees and guests to a scheduled meeting	Y		Y		Y		Y		Y	
Whiteboard	Whiteboard	Y		Y		Y		Y		Y	
File transfer	Upload files (e.g., presentation slides, multimedia files) and play files	Y		Y		Y		Y		Y	
Integration with internal/external tools and services	Support mobile devices access	Y		Y		Y		Y		Y	
Application/Screen sharing	Screen sharing	Y		Y		Y		Y		Y	
	Application sharing	Y		Y		Y		Y			N
Participant list & right management	Allow multiple people have presenter or moderator roles	Y		Y		Y		Y		Y	
Capture/ record/ playback	Recording meetings	Y		Y		Y		Y	Not Mac user	Y	
	Playback recorded meetings	Y		Y		Y		Y		Y	
Live video & Audio streaming	Support various types of multimedia files	Y .flv, .swf, .mp3, .mp4, .f4v		Y .swf, .mpg, .mov, .qt, .mpg4, .m4v, .wmv, .mp3		Y .flv, .swf, .mp3, .mp4, .f4v		Y .mp4, .wmv, .mov, .avi		Y .mov, .avi, .mepg, .wmv, .mp3	

	Resize videos and screen by individual	Y	Not resize video	Y		Y		Y		Y	Not resize videos
	Audio/video wizard or help	Y		Y		Y		Y		Y	

**NB:** Y – Yes; N - No



**Table 15 A comparison of key features in the five applications for enhancing flexible learning experience**

Feature categories	Required VCCS features	Adobe Connect		Blackboard Collaborate		Microsoft Lync Online		omNovia		WizIQ	
		Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support a small group of attendees at the same time	Y		Y		Y		Y		Y	
	Support a large group of attendees at the same time										
Integration with internal/ external tools and services	Support different operating systems	Y		Y		Y		Y		Y	
	Runs on different web browsers	Y		Y		Y		Y		Y	
	Support mobile devices access	Y		Y		Y		Y		Y	
	Provide a way of integrating VCCS into LC	Y		Y			N		N	Y	
Communication	VoIP	Y		Y		Y		Y		Y	
	Textual public messaging	Y		Y		Y		Y		Y	
	Textual private messaging	Y		Y		Y		Y		Y	Not between attendees
	Audio	Y		Y		Y		Y		Y	
	Video/webcam	Y		Y		Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Y		Y		Y		Y		Y	
	Customise chat text (font, size, colour)	Y	Not the font type	Y	Not the font colour	Y		Y		Y	
Application/ Screen sharing	Screen sharing	Y		Y		Y		Y		Y	
	Application sharing	Y		Y		Y		Y			N
Whiteboard	Using whiteboard	Y		Y		Y		Y		Y	
File transfer	Download learning resources	Y		Y		Y		Y			N
Live video & Audio streaming	Support various types of multimedia files	Y .flv, .swf, .mp3, .mp4, .f4v		Y .swf, .mpg, .mov, .qt, .mpg4, .m4v,		Y .flv, .swf, .mp3, .mp4, .f4v		Y .mp4, .wmv, .mov, .avi		Y .mov, .avi, .mepg, .wmv, .mp3	

				.wmv, .mp3							
	Resize videos and control full screen video	Y	Not resize video	Y		Y		Y		Y	Not resize videos
Breakout rooms	Breakout rooms	Y		Y			N		N	Y	
Service/support	Support multiple languages	Y (12)		Y (7)		Y (37)		Y (10)		Y	
Feedback/ polling	Polling	Y	Not exportable	Y		Y		Y		Y	Not exportable
Capture/ record/ playback	Access to recorded sessions	Y		Y		Y		Y		Y	
	Session playback	Y		Y		Y		Y		Y	

**NB:** Y – Yes; N - No

**Table 16 A comparison of key features in the five applications for supporting flexible teaching approaches**

Feature categories	Required VCCS features	Adobe Connect		Blackboard Collaborate		Microsoft Lync Online		omNovia		WiziQ	
		Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons
Supported communication channel	Support 50 or more attendees at the same time	Y		Y		Y		Y		Y	
	Support 1-20 attendees at the same time										
Communication	Email attendees and guests to a scheduled session	Y		Y		Y		Y		Y	
	Textual public messaging	Y		Y		Y		Y		Y	
	Textual private messaging	Y		Y		Y		Y		Y	Not between attendees
	Audio	Y		Y		Y		Y		Y	
	Video/webcam	Y		Y		Y		Y		Y	
	Hands-up or relevant action icons (e.g., slow down, agree, disagree, confusing, typing)	Y		Y		Y		Y		Y	
Service/ support	Review and edit a scheduled session	Y		Y		Y		Y		Y	
Live video & Audio streaming	Support presentation files and images (e.g., ppt, pdf, jpg, html)	Y		Y		Y		Y		Y	
	Support various types of multimedia files (e.g., swf, qt, wmv, mpg, mp3, m4v)	Y .flv, .swf, .mp3, .mp4, .f4v		Y .swf, .mpg, .mov, .qt, .mpg4, .m4v, .wmv, .mp3		Y .flv, .swf, .mp3, .mp4, .f4v		Y .mp4, .wmv, .mov, .avi		Y .mov, .avi, .mepg, .wmv, .mp3	
	Resize videos and control full screen video	Y	Not resize video	Y		Y		Y		Y	Not resize videos
Participant list & right management	Allow multiple people have presenter or moderator roles	Y		Y		Y		Y		Y	
File transfer	Upload files (e.g., presentation slides, quizzes, documents, multimedia files)	Y		Y		Y		Y		Y	

	Allow attendees to upload files	Y		Y		Y		Y		Y	
	Allow attendees to download files	Y		Y		Y		Y		Y	
Whiteboard	Allow attendees to drawing on the whiteboard	Y		Y		Y		Y		Y	
Application/ Screen sharing	Sharing screen and applications	Y		Y		Y		Y		Y	Not application
	Allow attendees to share screen or applications	Y		Y		Y		Y		Y	
Breakout rooms	Breakout rooms	Y		Y			N		N	Y	
Feedback/ polling	Polling	Y	Not exportable	Y		Y		Y		Y	Not exportable
Quiz/ survey	Quizzes	Y	Not exportable	Y		Y			N		N
Capture/ record/ playback	Sessions recording	Y		Y		Y		Y		Y	
	Review and edit a recorded session	Y		Y	Not editing	Y	Not editing	Y	Not editing	Y	Editing under way
	Control access to a recorded session	Y		Y		Y		Y		Y	
Usability	User tracking	Y	Partially from the system usage reports	Y			N	Y		Y	

**NB:** Y – Yes; N - No

**Table 17 A comparison of pricing of Adobe Connect, Blackboard Collaborate, Microsoft Lync Online, omNovia, and WizIQ**

Application	Features		Attendees		Storage capacity	Cost	
			With account	Without account		Month	Year
Adobe Connect	Individuals	Hosted	25		150GB needed	Price Negotiated	
	Enterprises	Hosted					
		On-premise					
		Managed Services					
Blackboard Collaborate	Enterprise/Department		100		100MB of multimedia 10MB or 20 MB of whiteboard 10MB of file transfer	Price Negotiated	
	Moderator Access		100				
	Single Room (vClass)		50-400				
Microsoft Lync Online	Lync Online (Plan 1)		N			\$2/user	
	Lync Online (Plan 2) *		250			\$6.5/user	
	Lync Online (Plan 3)		250			£6.75/user	
	As a part of Office 365 (Plan E1-E4)					£5.75-£16.5/user	
omNovia	Small and Medium		10			\$132	\$1320
			25			\$330	\$3300
			100			\$792	\$7920
			400			\$1688	\$16880
			1000			\$3560	\$35600
	Enterprise	Hosted Solution	5,000			Price Negotiated	
		On-Premise Solution					
WizIQ	Individual	Solo Pro	Unlimited	25	15GB	\$19	\$190
		Solo Unlimited	Unlimited	Unlimited	40GB	\$69	\$690
	Organisation	Small	5 teacher	100	40GB	\$99	\$990
		Medium	10 teacher	100	80GB	\$179	\$1790
		Enterprise				Price Negotiated	

**NB:** Empty cells refer to information is not available on their website

\* It will be free for Cardiff University schools as a part of the Microsoft Office 365 service supported by INSRV.

## DISCUSSION

In this chapter, it discusses the recommended VCCS applications linking with the user requirements from four aspects: (1) the use of the VCCS from the user's point of view, (2) the priorities of the user requirements and the VCCS applications, (3) the major uses and the VCCS applications, and (4) the challenges that users pinpointed.

### **The use of the VCCS in a general view**

The use of the VCCS is gradually noticed by educators. In this project, the participants clearly stated the use of the VCCS lies in that it provides flexibility for teaching and learning, especially for distance learners.

Firstly, the VCCS offers more learning opportunities for distance learners/students who take e-learning courses. In particular, it reflects on the following aspects:

- It makes the live synchronous learning possible.
- It helps to reduce distance learners to experience feelings of inadequacy and isolation.
- It may foster student-tutor and student-student relationships.
- Learners at different locations and time zones are able to attend an online learning session easier. It saves their time and cost spending on travel.
- The feature such as video calls in the VCCS allows communications between the lecturer/moderator and the distance learners easier than emails and phone calls.
- The features (e.g., file transferring, live messaging, screen sharing and whiteboard) in the VCCS make it possible for distance learners to meet online and do group work easier.
- The recordings of training sessions allow learners to play back and learn at their own pace when and where they feel want to.
- The VCCS decreases limitations from commitments which make it harder for learners such as who intend to attend a regular course but have limited time, who have mobility or health problems that make travel or attendance difficult, or who work irregular hours or shifts.

Secondly, the VCCS allows the educators to organise learning activities easier. It is easy to bring external participants (e.g., external experts, external examiners, mentors, supervisors, assessors, representatives, and interviewees) who are geographically elsewhere into an activity. It provides alternative ways of interaction and communication between people who are in different institutions to work together. It may work well in some subject areas where students get benefit from repeated viewing of content, especially when complex items are being discussed in the session. Meanwhile, it might help to deliver large group lectures online when the large lecture theatres at the university are not enough.

In addition, the flexible delivery supported by the VCCS promotes a move from traditional pedagogical paradigm. It reflects on key aspects as follows:

- It allows the trainers/lecturers to edit the recordings of lectures, tutorials, and training sessions, and further to tailor these learning materials.
- It gives people a chance to review teaching or allows peer review on the web, which will improve the quality of teaching.
- More and more universities are improving their quality and making the service more attractive in the university competition. Using the VCCS will potentially add the school reputations and recruit more students. With the opportunities such as e-learning materials are accessible to anyone as long as they have Internet access, and the support for synchronous learning, it will call people's attention to specific academic subjects and might be a draw for new learners that are interested in receiving ongoing training that fits their schedule.
- The recordings of lectures, tutorials, and training sessions are retention of teaching. It can be checked back and even used by the institution to deal with teaching policy-related issues.
- Different from the traditional face-to-face education, the learning technology is not used to feed learning content to students directly, rather it encourages students to learn at their own pace and learn from experience in using technologies.

In a general sense, it is the potential uses of the VCCS that have called the participant's attention.

### **Priority of the requirements and the VCCS applications**

It is clear that the use of some features in the VCCS has been increasingly asked by students in the schools. In accordance with different subjects and learning contents, there are different degrees of requirements for these features.

The schools that deliver e-learning courses for distance learners (e.g., the Section of Anaesthetic, Intensive Care and Pain Medicine, and the Institute of Tissue Engineering and Repair) are the users that need the VCCS urgently. They need the VCCS to deliver online lectures and tutorials to distance students. To some extent, they have adopted live chat tools such as Skype to support distance learners. However, to fully support various online activities, it is worthwhile for them to use a free VCCS tool as a start. AnyMeeting supports up to 200 users simultaneously, which is suitable for e-learning courses that have a large group of distance learners. To support a small group of synchronous attendees (10-30), Wiggio provides more features that are useful for educational activities. If the school has had certain experience of using the VCCS tools and prepared the investment to the VCCS, they may look into the five tools recommended in the second toolset and choose one based on their particular requirements and conditions in the school. The user may realise that there is no single application that is satisfy all their requirements. For example, omNovia supports large group of synchronous users at a time, but its cost is high. Microsoft Lync Online is a part of

Microsoft Office 365 for enterprises suite and it provides many handy features for people working in the same organisation, but it does not provide an integration solution with LMS. Adobe Connect offers many features that the users required, but some of the functions (e.g., message customisation, multimedia files playing) are not as robust as the features in the other applications. Blackboard Collaborate is well integrated in e-learning systems but it cannot be used as flexibly and collaboratively as Microsoft Lync Online does with other Microsoft products. Considering the key requirements from these schools (see comparison tables 13, 15, 16), Blackboard Collaborate is the most suitable tool. Microsoft Lync Online is not as good as Blackboard Collaborate as it does not provide an integrated solution with the LMS, it supports fewer multimedia types and it does not provide user-tracking reports.

For libraries and learning centres (e.g., Lifelong Learning Centre) that run various online training courses, having a reliable low-cost VCCS tool is in a high priority. At present, because they have little budget, a free VCCS tool is more suitable for them. Although AnyMeeting, TeamViewer and Wiggio provide many features, the users need to aware that each tool has some weakness. For example, AnyMeeting might not be suitable for users who want to access a live training session through iPad/iPhone; TeamViewer does not support web tour and polling; Wiggio has a problem of the recording function in the tested free version. Considering the crucial requirements from the users (see comparison table 7, 10, 11), in the short term, AnyMeeting should be able to support their learning activities. However, in the long run, the users will get immediately benefits if there was a solution of the VCCS at the university level. Generally speaking, without thinking of the cost, Adobe Connect, Blackboard Collaborate and Microsoft Online have provided good enough features for this group of users (see comparison table 12, 15, 16). If the users do not need to integrate the VCCS with LC, Microsoft Lync Online will be a good choice. Nevertheless, Blackboard Collaborate is outstanding regarding its thorough features to support flexible learning and teaching activities.

The VCCS is essential for some schools that have been using a VCCS tool. For example, the School of Mathematics are using the Access Grid video conferencing; the Department of Dermatology will use Blackboard Collaborate as Elluminate Live has merged with Blackboard; the Institute of Psychological Medicine and Clinical Neurosciences applies BigBlueButton and has technical support officers/developers to manage the open source project. In practice, these schools use the VCCS to run virtual classrooms, record lectures, share learning materials, and support online synchronous communications. The recommended VCCS tools in this report might not be a switch suggestion for them, but it hopes the users will share good practice and their experience of the practical challenges.

In the survey, it shows some schools do not have an urgent requirement for the VCCS, but have a high expectation to try any good VCCS application that will benefit teaching and learning. The lecturers/tutors/moderators may occasionally use these tools to contact with part-time students or make an online lecture presentation for a small group of students. They want to see any learning opportunity the technology will bring in. Adopting one of the recommended free software will be enough for their current use. However, in the long term,



there is a risk of maintaining the virtual classrooms because it is hard to tell whether the tool will be withdrawn, fully supported or become charged. Again, if there was a solution for VCCS at the university level, the users will definitely apply it.

## **Major uses and the VCCS applications**

It is hard to conceive of a university remaining competitive in today's marketplace without reaching beyond its physical boundaries. Schools have started to look into opportunities for supporting distance learners and e-learning. More and more students and learners who undertake university courses are asking for such service too. In a previous chapter, it described the main purposes of using the VCCS. It is a big challenge when people want every required feature in one software application. People need to realise that one tool might be very suitable for one or two use purposes, but not for every purpose of use. The use of the VCCS is not to replace the traditional classrooms but to enhance learning experience and provide more flexible teaching approaches.

For people who want to use the VCCS for training and tutoring, the most frequently asked functionality focuses on a variety of features that can be used for engaging and interacting with attendees. By the user's experience, a virtual classroom works best with a small group of ten or less, otherwise there is too much noise and loses cohesion. Although virtual classrooms can provide an excellent 'live' session, it is more difficult to control and run smoothly than a traditional face-to-face tutorial. It therefore needs diversified features to help online interactions. The features such as audio/video, recording, live chat, scheduling sessions, sharing screen and playing multimedia files are highly demanded. AnyMeeting, TeamViewer and Wiggio are free VCCS tools that provide many useful features. AnyMeeting is easy to use but has weakness to support mobile devices and the control of whiteboard functionality. TeamViewer supports interaction well but does not have polling, quizzes and some customisation features. Wiggio is particularly good for educational collaboration and group work. In general, AnyMeeting is good enough for the current requirements (see Table 7, 10, 11). In the long run, a charged tool provides more functions that the users may need in future. It can be seen in the Table 12 that Blackboard Collaborate almost contains all key features that users expected. Adobe Connect and Microsoft Lync Online provide enough features for the users too. In the short term, one of the three tools will satisfy the user immediately, however, considering the long-term use and specific learning activities, Blackboard Collaborate will be the most suitable one.

Nowadays, people are aware that simply putting one's lecture notes online is not enough because students expect more accessible and reusable learning materials. Thus, using the VCCS for supporting online lecture presentation was another requirement. The users expect it allows a large group of students to attend an online lecture presentation concurrently, and the recordings of the lectures can be made available for students to access later. The lecture capture tools have been applied by some schools already, for instance, the Law School applies Panopto. However, different from the lecture capture tool, the VCCS is not only considered as a means to allow distance learners to easily communicate with presenters and

peers, but also an alternative way when students miss a class. In the three free tools, only AnyMeeting supports large group attendees. The lecturer can try this tool as a start if they were thinking of making online lecture presentations for a large group of distance learners. Through the comparison in Table 13, it can be seen that both Blackboard Collaborate and Microsoft Lync Online offer comprehensive features for this use. Blackboard Collaborate is slightly better than Microsoft Lync Online on the aspect of supporting more types of multimedia files. omNovia is good too, but its lack of supporting Mac OS users is an obvious disadvantage. WizIQ offers enough features but it does not support application sharing and lacks some nice-to-have features (e.g., not allow private messaging between attendees).

The requirements for using the VCCS to support virtual meetings have some similarity to the use of training and tutoring. However, it does not emphasise the features that can be used to facilitate learning. TeamViewer as a free tool is appropriate for this use as it provides all key features the user required. The five charged applications are all good enough for this use too. With an all-out comparison in Table 14, Blackboard Collaborate is outstanding again as it is a bit better than Adobe Connect and Microsoft Lync Online on the aspects of supporting more types of multimedia files and allowing users to resize screen.

The users have seen the potential of the VCCS applications. They expect that the VCCS tool can be easily combined with other e-learning methods, for instance VLEs, asynchronous discussions, wikis, mobile apps and other social media tools. As a free tool, AnyMeeting, TeamViewer, and Wiggio has its own strengths and weaknesses. To the point of giving students more flexible learning opportunities, AnyMeeting is not suitable for users who want to use iPad/iPhone or who prefer a non-English language interface. TeamViewer does not allow users to customise chat messages and use polling to obtain quick feedback. Wiggio has a problem of using its recording function (may be not in the paid version). As a charged tool, each of the five VCCS applications offers impressive functionalities that are enough for the user's urgent requirements. Apparently, Blackboard Collaborate and WizIQ are designed for educational purposes and both provide comprehensive features for attendees and moderators to use. Both Microsoft Lync Online and omNovia do not provide a solution for the integration with an existing LMS (e.g., Moodle, Desire2Learn or Blackboard) and no function of breakout rooms. The support officers need to do extra development to make it integrate with the existing communications infrastructures. To this point, Blackboard Collaborate will be the best tool for supporting teaching and learning activities.

### **Challenges of using the VCCS**

As Hiltz (1995, p.196) said, "A virtual classroom is not the proper mode for all faculty or all students." There is no single VCCS application can fit all users' requirements. To some extent, the users have realised the pedagogical and socio-economic forces, such as greater information access, synchronous and asynchronous learning; increased cooperation and collaboration, cost-effectiveness and pedagogical improvement. Three aspects of challenges regarding to the use of VCCS in teaching and learning have been stated by the participants.

One is the human factor, one is the technology factor, and the other is the service support factor.

The human factors refer to the factors that are related to educators and learning activity support members in practice teaching with particular environments, products, or services. It implies on the following points:

- It is a challenge for the lecturer/presenter to manage a large group of students in a virtual classroom because it is not face-to-face interaction at a physical venue. The question has been asked is how well can the lecturer make a presentation while playing slides and at the same time check the student understands.
- Online course design and teaching approaches largely reply on the lecturer/moderator. Therefore a student may have different learning experiences in an e-learning course leading by different lecturers. It is primarily up to the lecturer/moderator to adopt flexible ways to encourage interaction and engage students to learn. The features provided by the VCCS can be used by different lecturer in different ways.
- Not all educators prefer to apply new learning technologies in teaching. For some schools and subjects, it is tough and takes time to change the lecturer's views and attitudes to new learning technologies.
- With the expansion of distance learning, available open educational resources, and collaborative education between universities, it requires the lecturers to apply new pedagogical methods to provoke interaction and communication in e-learning.

The technology factors refer to the most often mentioned concerns about a product relating to the usage of the VCCS in teaching and learning. Some users have realised that they may encounter problems with software compatibility, connection, connection speed, server unreliability, computer problems, etc., and stated the following aspects particularly:

- How easy the application can be learned and operated;
- How stable and reliable the application is;
- How is the quality of the application to support a large group of attendees synchronously in a session;
- How good the recording functionality is;
- How flexible features that application offers for the lecturer to engage learners at different levels (e.g., customisation functions and multiple languages);
- What alternative functionalities it has if a particular demanding functionality is not included in the application;
- How easy it is to integrate with other existing systems;
- How good the technology is to help the lecturer to assess and check the student's learning;
- How good it is to run on mobile devices.

The service support factors refer to the requirements that the service support members need to consider. It reflects on two points as follows:

- The cost of the software services (e.g., cost of setting up the VCCS system, operational costs, multimedia PCs, more bandwidth for higher quality learning materials);
- Training for both learning technology support members, trainers and learners. The training should be regularly conducted rather than one-off.

## CONCLUSION

Originated from comments from the university VLE user group meetings, this project aims to analyse the existing user requirements for the VCCS and review available tools fit for these requirements. This report shows the findings.

Focused on collating and prioritising existing user requirements for the VCCS, it firstly applied an online questionnaire to collect the user's requirements. Fifteen participants from eleven faculties contributed to this project. The questionnaire was designed to mark what features in the VCCS is needed. It helps us to clarify how important a feature is for the user in a particular learning activity. The criteria for the feature were referred to some popular software benchmarks. More important, the follow-up interviewing with the participant helped us to understand the particular requirement in detail.

Shown in the Analysis chapter, the users have fairly positive views about the VCCS. They see the potential of its use and expect the application is robust and reliable. It found that the participants need the VCCS on six main aspects: to facilitate online training and tutoring; to support lecture presentation; to run virtual meetings; to provide flexible learning experience for students; to have more flexible teaching approaches to teaching; and to support subjects related special learners. Each purpose of the use has its own needs for the essential features. Online training and tutorials require various features to support interaction and engagement. At present, recording, live chat, screen/application sharing and audio/video functions are the most important features for trainers and tutors. Online lecture presentation requires that it supports high quality presentations and a large number of attendees synchronously. At present, supporting a large number of attendees, presenting slides, playing various types of multimedia files, audio/video and recording are essential features. Virtual meetings need fewer features of supporting educational activities comparing with the use of online training and tutoring. It mostly needs features: live chat, screen/application sharing and audio/video and file transferring. However, this use is not as urgent as the previous two uses. In a more pedagogical view, there are high expectations for diverse features in the use of the VCCS for enhancing flexible learning environment, including both enhancing learning opportunities for students and more flexible teaching approaches for educators. The more expected features include file transferring, quizzes, application sharing, inviting external participants, customisation, mobile accessing, and tracking students learning outcomes. In addition, some features (e.g., customisation, supporting mathematics symbols, and statistics reports) become vital in relation to some specific subjects. Although this use is not a general requirement, it needs to be evaluated in regard with the specific subject and/or school. There are also some key common features mentioned by the participants, including "easy to use", "runs on all major computer platform", "support popular web browsers" and "a robust and reliable system". It is difficult to test them but they are essential criteria for evaluating a VCCS tool.

Referring to the information provided by the participants and the review resources in the market, forty-six applications were selected. By comparing the accessibility, cost, functionalities and support services, it found that eight applications to a large degree fit for the user's requirements. It can be seen that a few VCCS products (Wiggio, Blackboard Collaborate, and WizIQ) were originally designed for higher education specifically. It suggests that AnyMeeting, TeamViewer and Wiggio provide the most needed features to users who have low budgets and who want to apply a VCCS tool quickly. In general,

AnyMeeting supports both small group and large group synchronous attendees, though it does not support mobile devices in the current version. Considering the current urgent requirements, it is good enough to support the use of online training and tutoring. TeamViewer contains all required features for supporting the use of running virtual meetings. Wiggio is very good at supporting collaborative group work. In the long run, a charged VCCS tool is more reliable than the three free tools. It found that five non-free tools have provided most needed features. They are Adobe Connect, Blackboard Collaborate, Microsoft Lync Online, omNovia, and WizIQ. OmNovia lacks of supporting Mac OS users and WizIQ does not have application sharing and allow attendees to download learning resources in the current version. Thus, these two applications are not as reliable as the other three applications. To satisfy the current urgent requirements, all Adobe Connect, Blackboard Collaborate and Microsoft Lync Online are good enough to support the use of training/tutoring, the use of lecture presentations and the use of virtual meetings. However, by comparing more, it can be seen that Adobe Connect offers almost all required features, but it is not as robust as Blackboard Collaborate and Microsoft Lync. For example, it does not allow attendees to resize video and polling result is unable to be exported. Microsoft Lync Online as a part of Microsoft 365 Office provides remarkable features for people to work collaboratively. It is outstanding to support the use of virtual meetings and lecture presentations. However, considering its further use to support learning and teaching activities, it lacks of breakout rooms, allowing users to edit a recording file, and requires third-party solutions for integrating with an existing LMS. In the long term, its weakness to some extent will require extra development input and further investment. Blackboard Collaborate has acquired two leading providers of synchronous and collaboration technologies (Eliminate Live and Wimba). With its design purpose for education, it well supports learning and teaching activities. Comparing to Microsoft Lync Online, it provides better features such as more types of multimedia files and can easily be integrated with the current LMS. In the recommended eight tools, Blackboard Collaborate supports all purposes of the VCCS use. Considering both short term and long term of using a VCCS tool, Blackboard Collaborate is a better choice for the users who apply the university provided LMS.

It is hoped the report helps the learning technology support staff to better understand the user requirements for the VCCS and will serve as a basis for supporting strategic decisions. It also hoped the report provides useful information for the users, including what are the major uses of the VCCS in the school; which tool may satisfy their requirements if they need a VCCS tool urgently; in the long run, which application may be more suitable for their teaching and learning activities; and the challenges they may encounter.

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## APPENDICES

### **Appendix 1: The recruitment email to Learning Central domain administrators.**

Subject: Call for participants for analysis of virtual classroom requirements

Dear colleague,

The Learning Technology Team, INSRV is undertaking an analysis of users' requirements for virtual classroom tools.

*A virtual classroom is an online service to support both synchronous and asynchronous e-learning activities. It may involve overlapping scopes of interaction such as virtual courses, online meeting, and online presentation. It supports activities and interactions through functionalities such as video, voice, chat, screen sharing, webinar, whiteboard, threaded discussion boards and so on.*

If you have experience of using or intend to use virtual classroom tools, we would like to invite you to participate in a questionnaire survey and an interview (about 30 minutes). You will help us to define the required features of a virtual classroom service which you believe would be relevant to your teaching or service activities.

If you are willing to join the survey, please contact Jin Tan ([sisjt1@cf.ac.uk](mailto:sisjt1@cf.ac.uk)) in the Learning Technology Team INSRV with your information (name, email, and school).

We could like to emphasise that this investigation is for the purpose of improving Learning Central Service at the university level only and it will not be possible for any participant to be personally identified.

If you feel that this is something that your colleagues may wish to provide input to, please feel free to forward on this email.

Your participation is greatly appreciated.

Best regards.

Peter Rayment

Learning Technology Manager, INSRV.

## Appendix 2: Questionnaire - user requirements for the VCCS

### Users' Requirements for Virtual Classroom/Collaboration Tools Survey



#### Virtual Classroom/Collaboration Tools Requirements

*This questionnaire can either be completed and submitted in one session or you can fill it in partially, bookmark it and then return later to add additional information. You can then submit it when it is completed.*

If you want to bookmark and finish the survey later, please use the Finish Later button at the bottom of the page. You will then receive instructions on how to bookmark the page.

Once you have completed all the questions below and are ready to submit the fully completed survey, click on the CONTINUE button at the bottom of the page. Your answers will be submitted or you will be prompted to fill in an answer you may have over-looked. Once your answers are accepted as submitted you cannot return to review or amend this page.

Thank you.

Learning Technology Team, INSRV, Cardiff University

About you
<b>1. Your name</b> <input type="text"/>
<b>2. Your school/directorate</b> <input type="text" value="Select an answer"/> If you selected Other, please specify: <input type="text"/>
<b>3. Your e-mail (Optional)</b> <input type="text"/>
<b>4. Please let us know if you have used or intend to use any virtual collaboration tools below.</b> <i>(select all that apply)</i> <input type="checkbox"/> Blackboard - Virtual classroom <input type="checkbox"/> Blackboard - Chat <input type="checkbox"/> Elluminate Live <input type="checkbox"/> Wimba classroom <input type="checkbox"/> BigBlueButton <input type="checkbox"/> Blackboard Collaborate <input type="checkbox"/> Other <i>(please specify)</i> : <input type="text"/>
<b>5. Basically, what do you (or would you like to) use the virtual collaboration tools for?</b> <i>(select all that apply)</i> <input type="checkbox"/> Support Learning and Teaching activities <input type="checkbox"/> Interact with distant learners <input type="checkbox"/> Web meeting/conferencing <input type="checkbox"/> Instant messaging <input type="checkbox"/> Lecture presentation <input type="checkbox"/> Voice authoring (e.g., Voice Presentation, Voice Email) <input type="checkbox"/> Other <i>(please specify)</i> : <input type="text"/>
<b>6. Who would you like to collaborate with using the virtual collaboration tools?</b> <i>(select all that apply)</i> <input type="checkbox"/> Students <input type="checkbox"/> Other staff <input type="checkbox"/> Externals or distance users <input type="checkbox"/> Mix of Staff, Students and Externals <input type="checkbox"/> Other <i>(please specify)</i> : <input type="text"/>

**Information Gathering - Features of a virtual collaboration tool**

**7. Common Operation** - Please rate the importance to you of the following needs:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Simple and easy to navigate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Organised and easy to follow structure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Easily and quickly transit between different types of content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Be able to configure profiles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Be able to view other users' profiles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Automatic reconnection if the Internet outage occurs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Keyboard shortcuts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**8. Communication** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Real time textual public messages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Real time textual private messages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Real time voice messages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Discussion areas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. E-mail to participants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Adjustable screen/window/background colour	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Customise texts (resize, font, colour)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Audible alerts of activity (e.g., new message, users joined, users left)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Be able to use emoticon indicators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Be able to see who joined and who is online	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Be able to check chat history	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**9. Live Video & Audio Streaming** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Be able to test your audio locally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Be able to adjust individual user volume	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Audio/webcam setup wizard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Drag & Drop reordering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Play multimedia files (e.g., video, audio, Flash, QuickTime, mpg, m4v, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Play slides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Re-size videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Full Screen Video	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**10. Whiteboard** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Real time whiteboard content delivery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Initial tool-set & functions (e.g. Shared pointer, Select Tool, Highlight pen / Pencil / Free draw / Magic Pen, Line/Arrow tool, Rectangle, Ellipse, Triangle, Polygon, Star, Text, Undo, Redo, Cut, Copy, Paste, Delete, Erase page)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Extensible architecture to allow future addition of new tools (e.g. mathematical symbols, scientific notation)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Multiple participants can use the whiteboard simultaneously	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Multiple whiteboard screens available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Whiteboard can be scaled by user	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Copy/paste anything from desktop to whiteboard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Save whiteboard snapshot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**11. Application/Screen sharing** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Participants can share screen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Moderators can force participants to view the application sharing window full screen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Share your applications to participants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Publish web URLs and allow other people to access websites	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**12. File transfer** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Share repository and allow other people to access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Exchange different types of files between users synchronously	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Files locked to others during editing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Be able to upload multimedia files	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Be able to download content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Be able to convert files to required types	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**13. Capture/record/playback** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Moderators can control if a session can be recorded, stored, exported or printed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Moderators can control if a session/content can be accessed/play-backed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**14. Break out rooms** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Moderators can easily transit between rooms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Moderators can lock rooms to restrict further access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**15. Participant list & rights management** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Configure user roles and permissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Remove participants from sessions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Easily setup for external contributors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Icons to display capabilities by participants (e.g., mic, speaker, webcam, phone, screenshare)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Setup groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**16. Feedback/polling** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Yes/No Polling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. On-the-fly polling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Polling results can be made public or private	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Be able to export polling results	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**17. Quiz** - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Be able to create quizzes/surveys	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Be able to export quiz/survey results	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. Additional tools - Please rate the importance of the following features:

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. Planning tools allow moderators to prepare and schedule sessions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Assessment tools allow moderators to mark	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. Do you require integration with internal/external tools and services?

	No interest	Some interest	I would use this feature	Quite important to me	Essential to me
a. CardiffMail (Lotus Notes) (or any other email system).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. iPhones/Blackberry devices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Microsoft Office (open/save to/from MS Office)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Learning Central	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Google apps (e.g. Docs and Gadgets)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. By your experience, are there any limitations to the virtual collaboration tools you currently use? *(Optional)*

Yes  No

If yes, please explain briefly what those limitations are:

21. Please list any important features of a virtual collaboration tool (if not covered above): *(Optional)*

22. If you feel the above questions have not clarified your needs, please briefly describe here: *(Optional)*

23. If you have further comments, please list here: *(Optional)*

### Appendix 3: The participants' information

Alias	School	Department	Position
Alice	Library	Health library	Distance Learning Librarian
Bill	Medicine	Section of Anaesthetics, Intensive Care and Pain Medicine	E-Learning Technologist
Dale	Medicine	Institute of Psychological Medicine and Clinical Neurosciences	Course Tutor (Distance learning)
Jaime	Medicine	Department of Dermatology	Learning Technologist
Kara	Medicine	Institute of Translation, Innovation Methodologies & Engagement	Senior Lecturer
Chris	Healthcare Studies		Lecturer
Lewis	Pharmacy and Pharmaceutical Sciences		Lecturer
Marco	Dentistry	Institute of Tissue Engineering and Repair	Reader
Nikolas	Nursing and Midwifery Studies		Lecturer
Eric	Biosciences		Lecturer
Farina	Lifelong learning		Professional Development Officer
Ivan	Lifelong learning		Lecturer
Gloria	English, Communication, and Philosophy	Centre for Language and Communication Research	Lecturer
Harris	Mathematics		Systems Manager
Owen	Law		IT Manager

**NB:** Regarding to the Data Protection Act (1998), the participant's real name is not identical.

#### Appendix 4: VCCS Evaluation - criteria, categories and features

Criteria	Categories	Features	Evaluation methods
Teaching and Learning Features	Common operation	<ul style="list-style-type: none"> <li>• Simple and easy to navigate</li> <li>• Organised and easy-to-follow structure</li> <li>• Easy to quickly transition between different types of content</li> <li>• Configure profiles</li> <li>• View other participants' profiles</li> <li>• Automatic reconnection if the Internet outage occurs</li> <li>• Keyboard shortcuts</li> </ul>	<ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Literature review</li> <li>• Testing</li> </ul>
	Communication	<ul style="list-style-type: none"> <li>• Real time textual public messages</li> <li>• Real time textual private messages</li> <li>• Real time voice messages</li> <li>• Discussion areas</li> <li>• E-mail to participants</li> <li>• Adjustable screen/window/background colour</li> <li>• Customise texts (resize, font, colour)</li> <li>• Audible alerts of activity (message, joined, left)</li> <li>• Be able to use emoticon indicators</li> <li>• Be able to see who joined/online</li> <li>• Be able to see check chat history</li> </ul>	
	Live Video & Audio Streaming	<ul style="list-style-type: none"> <li>• Test your audio locally</li> <li>• Adjust individual user volume</li> <li>• Audio/webcam setup wizard</li> <li>• Drag &amp; Drop reordering</li> <li>• Play multimedia file (video, audio, Flash, QuickTime, mpg, m4v, etc.)</li> <li>• Play slides</li> <li>• Resize videos</li> <li>• Full Screen Video</li> </ul>	
	Whiteboard	<ul style="list-style-type: none"> <li>• Real time whiteboard content delivery</li> <li>• Initial toolset &amp; functions (Shared pointer, Select Tool, Highlight pen / Pencil</li> </ul>	



		<p>/ Free draw / Magic Pen, Line/Arrow tool, Rectangle, Ellipse, Triangle, Polygon, Star, Text, Undo, Redo, Cut, Copy, Paste, Delete, Erase page)</p> <ul style="list-style-type: none"> <li>• Extensible architecture to allow future addition of new tools (e.g. mathematical symbols, scientific notation)</li> <li>• Multiple participants can use the whiteboard simultaneously</li> <li>• Multiple whiteboard screens available</li> <li>• Whiteboard can be scaled by user</li> <li>• Copy/paste anything from desktop to whiteboard</li> <li>• Save whiteboard snapshot</li> </ul>	
	Application/ Screen sharing	<ul style="list-style-type: none"> <li>• Participants can share screen</li> <li>• Moderators can force participants to view the application sharing window full screen</li> <li>• Share your applications to participants</li> <li>• Publish URLs and allow users to access websites</li> </ul>	
	File transferring	<ul style="list-style-type: none"> <li>• Users can share repository and allow other people to access</li> <li>• Exchange different types of files between users synchronously</li> <li>• Files locked to others during editing</li> <li>• Be able to upload multimedia files</li> <li>• Be able to download content</li> <li>• Be able to convert files to required types</li> </ul>	
	Capture/ record/ playback	<ul style="list-style-type: none"> <li>• Moderators can control of sessions can be recorded, stored, exported or printed</li> <li>• Moderators can determine if a session/content can be accessed/ played back</li> </ul>	
	Break out rooms	<ul style="list-style-type: none"> <li>• Moderators can easily transit between rooms</li> <li>• Meeting rooms can be locked to prevent joining by moderators</li> </ul>	
	Participant list & rights management	<ul style="list-style-type: none"> <li>• Configure user roles and permissions</li> <li>• Remove participants from sessions</li> <li>• Easily setup for external contributors</li> <li>• Icons to display capabilities by participants (mic, cam, phone, screenshare)</li> <li>• Setup groups</li> <li>• Allow multiple moderators</li> </ul>	

	Feedback/polling	<ul style="list-style-type: none"> <li>• Yes/No Polling</li> <li>• On-the-fly polling</li> <li>• Polling results can be made public or private</li> <li>• Export polling results</li> </ul>	
	Quiz/ Survey	<ul style="list-style-type: none"> <li>• Support Quiz/survey</li> <li>• Can export quiz/survey results</li> </ul>	
	Additional tools	<ul style="list-style-type: none"> <li>• Planning tools allow moderators to prepare and schedule</li> <li>• Assessment tools allow moderators to mark</li> </ul>	
	Integration with internal/external tools and services	<ul style="list-style-type: none"> <li>• Cardiffmail (Lotus Notes)</li> <li>• Mobile devices</li> <li>• Microsoft Office</li> <li>• Learning Central</li> <li>• Google apps (e.g., Docs and Gadgets)</li> </ul>	
	Group calendar		
Administration	Pricing & Licensing		<ul style="list-style-type: none"> <li>• Literature review</li> <li>• Testing</li> </ul>
	Platform	<ul style="list-style-type: none"> <li>• Mac</li> <li>• Windows</li> <li>• Linux</li> </ul>	
	Hardware	<ul style="list-style-type: none"> <li>• Webcam, earphone, speaker, microphone</li> </ul>	
	Remote support	<ul style="list-style-type: none"> <li>• Stand phone lines</li> <li>• VoIP</li> <li>• Installation required</li> <li>• Remote control</li> </ul>	
	Supported communication channel	<ul style="list-style-type: none"> <li>• One-to-one</li> <li>• One-to-many</li> <li>• Many-to-many</li> <li>• Maximum connected users</li> </ul>	
	Web browser	<ul style="list-style-type: none"> <li>• IE</li> <li>• Firefox</li> <li>• Chrome</li> </ul>	

		<ul style="list-style-type: none"> <li>• Safari</li> </ul>	
	Additional features	<ul style="list-style-type: none"> <li>• Additional download or plug-ins</li> <li>• Multiple language interface is available</li> <li>• Easy development</li> </ul>	
	Network	<ul style="list-style-type: none"> <li>• Minimal network bandwidth needs for delivery</li> <li>• Stable hosting</li> </ul>	
	Security	<ul style="list-style-type: none"> <li>• Support SSL Encryption</li> <li>• Server software can be hosted securely behind a firewall</li> </ul>	
	Services/Support	<ul style="list-style-type: none"> <li>• Accessible standards and features</li> <li>• Well developed training and resources available if needed</li> <li>• Able to provide technical support 24/7</li> <li>• Supplier's profitable and stability</li> </ul>	
	Product maturity	<ul style="list-style-type: none"> <li>• Version level</li> </ul>	
	Usability	<ul style="list-style-type: none"> <li>• Webinars</li> <li>• Demonstrations</li> <li>• Training</li> <li>• Brainstorming sessions</li> <li>• Search</li> <li>• User tracking</li> <li>• Data sorting</li> <li>• Tutoring</li> <li>• Large group lecturer presentations (more than 200 attendees)</li> <li>• Interaction means</li> </ul>	

## Appendix 5: A full list of the VCCS

	VCCS Name	URL	Availability
1	AccessGrid (AG) video conferencing	<a href="http://www.ja.net/services/video/agsc/AGSCHome/">http://www.ja.net/services/video/agsc/AGSCHome/</a>	Not free. By JANET
2	Adobe Acrobat Connect Pro	<a href="http://www.adobe.com/uk/products/acrobatconnectpro/elearning/virtualclassroom.html">http://www.adobe.com/uk/products/acrobatconnectpro/elearning/virtualclassroom.html</a>	Free 30-day trial
3	AnyMeeting	<a href="http://blog.anymeeting.com/webinars/the-new-anymeeting-is-here/">http://blog.anymeeting.com/webinars/the-new-anymeeting-is-here/</a>	Sign-up free
4	AT&T connect	<a href="http://www.business.att.com/enterprise/Family/unified-communications/business-collaboration-services/">http://www.business.att.com/enterprise/Family/unified-communications/business-collaboration-services/</a>	Free 30-days trial; need telephone number to confirm registration
5	BigBlueButton	<a href="http://www.bigbluebutton.org/">http://www.bigbluebutton.org/</a>	Open source License, through JISC
6	Tools in Blackboard Learn	Collaboration - Virtual Classroom/Chat In Learning Central	Included in LC. Java plug-in does not work
7	Blackboard Collaborate	<a href="http://www.blackboard.com/platforms/collaborate/overview.aspx">http://www.blackboard.com/platforms/collaborate/overview.aspx</a> (Elluminate Live and Wimba classroom have been acquired by Blackboard in 2010)	Free 30-days trial
8	Citrix online	GoToTraining <a href="http://www.gotomeeting.com/fec/training/online_training">http://www.gotomeeting.com/fec/training/online_training</a> GoToWebinar <a href="http://www.gotomeeting.com/fec/webinar">http://www.gotomeeting.com/fec/webinar</a>	Free 30-days trial; need to provide credit card information.
9	DimDim	<a href="http://www.dimdim.com">http://www.dimdim.com</a> (Dimdim has been acquired by Salesforce.com in Jan 2011)	Not free
10	Echo 360	<a href="http://echo360.com/echosystem/scale/">http://echo360.com/echosystem/scale/</a>	Not free
11	Electa	<a href="http://www.e-lecta.com">http://www.e-lecta.com</a>	Free 14-day trial; register being suspended without reasons
12	Fuze meeting	<a href="https://www.fuzebox.com/">https://www.fuzebox.com/</a>	Free 14-day trial; need to provide credit card information.
13	Google+ Hangouts	<a href="http://www.google.com/+learnmore/hangouts/">http://www.google.com/+learnmore/hangouts/</a>	Sign-up Free; need participants have a Google+ account
14	iiMeeting	<a href="http://iimeeting.com/English/">http://iimeeting.com/English/</a>	Sign-up Free; applying BigBlueButton
15	iMeet	<a href="https://imeet.com/">https://imeet.com/</a>	Free 30-day trial; need credit card information.
16	Intercall	<a href="http://www.intercall.com">http://www.intercall.com</a>	Not free

17	Jigsaw meeting	<a href="http://www.virtualclassroomssoftware.com/">http://www.virtualclassroomssoftware.com/</a>	Free 30-day trial; had problem of launching a session after added an image and a video file into the session.
18	join.me	<a href="https://join.me">https://join.me</a>	Sign-up Free, no whiteboard and recording
19	knoodle	<a href="http://www.knoodle.com/start-free-trial">http://www.knoodle.com/start-free-trial</a>	Free 30-day trial; no whiteboard and live session recording
20	MeetingBurner	<a href="https://www.meetingburner.com/">https://www.meetingburner.com/</a>	Sign-up free; 30-Day free trial for Pro and Premier versions; no whiteboard and recording in free version
21	Microsoft Lync Online	<a href="http://www.microsoft.com/en-gb/office365/get-office365.aspx">http://www.microsoft.com/en-gb/office365/get-office365.aspx</a> (included in Microsoft Office 365, which aims to replace the existing Domino/Notes system)	Trial version through INSRV IT
22	mikogo	<a href="http://www.mikogo.com/">http://www.mikogo.com/</a>	Free 14-day trial; no Mac OX version for hosting a session and need to download/install.
23	mindflash	<a href="http://www.mindflash.com/welcome/">http://www.mindflash.com/welcome/</a>	Free 30-day trial; Not for synchronous teaching.
24	omNovia	<a href="http://www.omnovia.com/trial">http://www.omnovia.com/trial</a>	Free 20-day trial
25	OnSync	<a href="http://www.digitalsamba.com/en-UK/main">http://www.digitalsamba.com/en-UK/main</a>	Free 30-day trial; running screen sharing has errors
26	ooVoo	<a href="http://www.oovoo.com/home.aspx">http://www.oovoo.com/home.aspx</a>	Have free version; no whiteboard, screen sharing and ads not free
27	PaltalkExpress	<a href="http://www.paltalk.com/express/">http://www.paltalk.com/express/</a>	Have free version; no whiteboard, polling
28	ReadyTalk	<a href="https://www.readytalk.com/try-buy/try">https://www.readytalk.com/try-buy/try</a>	Free 30-day trial; need to provide credit card information
29	Saba Centra Classroom	<a href="https://cloud.saba.com/">https://cloud.saba.com/</a>	Free 30-day trial
30	ShowDocument	<a href="http://www.showdocument.com">http://www.showdocument.com</a>	Free version; many limits; Professional version has free 30-days trial
31	Skype	<a href="http://www.skype.com/intl/en/home?intcmp=wlogo">http://www.skype.com/intl/en/home?intcmp=wlogo</a>	Have free version; no whiteboard
32	TeamViewer	<a href="http://www.teamviewer.com/en/products/meeting.aspx">http://www.teamviewer.com/en/products/meeting.aspx</a>	Have free version
33	Twiddla	<a href="http://www.twiddla.com/">http://www.twiddla.com/</a>	Free 30-day trial; does not support webcam and playing multimedia files

34	Yugma web conferencing	<a href="https://web.yugma.com/">https://web.yugma.com/</a>	Free version; 30 minutes session, two participants in a session
35	Yuuguu	<a href="https://www.yuuguu.com/s/home">https://www.yuuguu.com/s/home</a>	Free 7-day trial; help resources are not enough
36	VideoSeminarLive	<a href="https://www.videoseminarlive.com">https://www.videoseminarlive.com</a>	Free 14-day trial; no whiteboard, participant's screen sharing does not work
37	VoiceThread	<a href="http://voicethread.com">http://voicethread.com</a>	No free trial; have 30-day unconditional money back guarantee
38	Voluxion	<a href="http://www.voluxion.com/en/webinar-software-voluxion.html">http://www.voluxion.com/en/webinar-software-voluxion.html</a>	Not free
39	Vyew	<a href="http://vyew.com/s/">http://vyew.com/s/</a>	Have free version
40	VenueGen	<a href="http://www.VenueGen.com">http://www.VenueGen.com</a>	Have free version, 3 participants and no recording
41	Watchitoo	<a href="http://www.watchitoo.com">http://www.watchitoo.com</a>	Free 30-day trial
42	WebEx	<a href="http://www.webex.co.uk/">http://www.webex.co.uk/</a>	Free 2 weeks trial; 3 participants, no polling
<b>43</b>	<b>Wiggio</b>	<a href="http://wiggio.com/">http://wiggio.com/</a>	<b>Have free version</b>
<b>44</b>	<b>WizIQ</b>	<a href="http://www.wiziq.com">http://www.wiziq.com</a>	<b>Free 30-day trial</b>
45	Zipcast	<a href="http://www.slideshare.net/zipcast">http://www.slideshare.net/zipcast</a>	Need Slideshare account. Free version does not have video feature
46	Zoho meeting	<a href="https://www.zoho.com/meeting/">https://www.zoho.com/meeting/</a>	Have free version; 1 participant

**NB:**

- Texts in gray colour – VCCS products that have not been tested as they are dismissed by participants, do not provide any free or trial version, or do not have the required key features.
- Texts in green colour – VCCS products that have not been tested as they are using by participants/schools relating to a particular academic field.
- Texts in chocolate colour – VCCS products that have not been tested as they request users' credit information when register a trial version.
- Texts in purple colour – A free version of the VCCS product has been tested but the features are not good enough in relation to a specific use.
- Texts in blue colour – A trial version of the VCCS product has been tested but the features are not good enough in relation to a specific use.
- Texts in red colour and **in bold** – A free version of the VCCS product has been tested, and it contains they key features in relation to a specific use.
- Texts **in bold** – A trial version of the VCCS product has been tested, and it contains the key features in relation to a specific use.

## Appendix 6: An overview of 10 VCCS with a free register version

VCCS Name	Advantages	Disadvantages in a specific use					Disadvantages in common requirements
		Training/Tutoring	Lecture presentation	Virtual meetings	Flexible learning experience	Flexible teaching approaches	
iiMeeting (using BigBlueButton)	<ul style="list-style-type: none"> <li>• 25 participants limit</li> <li>• Whiteboard</li> <li>• Chat</li> <li>• Customise screen and font</li> <li>• Audio/Video</li> <li>• Open source</li> </ul>	<ul style="list-style-type: none"> <li>• Not breakout rooms</li> <li>• No recording</li> <li>• Cannot check chat history</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• Limited file transfer functionality</li> </ul>	<ul style="list-style-type: none"> <li>• Participants cannot share screen</li> <li>• No supported ways of playing back a session</li> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• Be unable to email invitation in a session</li> <li>• Be unable to upload multimedia files</li> <li>• Recording functionality is under development</li> <li>• Not allow multiple moderators</li> </ul>	<ul style="list-style-type: none"> <li>• Not Ads free</li> </ul>
Join.me	<ul style="list-style-type: none"> <li>• 250 participants limit</li> <li>• Sharing screen</li> <li>• Audio</li> <li>• File transferring</li> <li>• Remote control</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> <li>• No breakout rooms</li> <li>• No recording</li> <li>• Cannot check chat history</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No video in the free version</li> </ul>	<ul style="list-style-type: none"> <li>• No video</li> <li>• No whiteboard</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No supported ways of playing back a session</li> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No schedule functionality</li> <li>• Not support playing slides</li> </ul>	<ul style="list-style-type: none"> <li>• Moderators need to download and install it</li> <li>• Have errors when ended screen sharing</li> </ul>
MeetingBurner	<ul style="list-style-type: none"> <li>• Sharing screen and applications</li> <li>• Statistic reports about attendee's activities and can be exported</li> </ul>	<ul style="list-style-type: none"> <li>• 12 participants limit</li> <li>• No whiteboard</li> <li>• No breakout rooms</li> <li>• Cannot check chat history</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot send message to other attendees</li> <li>• No supported ways of playing back a session</li> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• Be unable to email invitation in a session</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• Participants have problems to view multimedia files shared by the presenter</li> </ul>
ooVoo	<ul style="list-style-type: none"> <li>• Control saving chat history</li> <li>• File transferring</li> <li>• Recording and playback</li> </ul>	<ul style="list-style-type: none"> <li>• 12 participants limit</li> <li>• Record up to 5 minutes per video message</li> <li>• No screen and applications sharing</li> <li>• No whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• Limited recording</li> <li>• No screen and applications sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Limited recording</li> <li>• No screen and applications sharing</li> </ul>	<ul style="list-style-type: none"> <li>• No screen and applications sharing</li> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• No screen and applications sharing</li> <li>• No schedule functionality</li> </ul>	<ul style="list-style-type: none"> <li>• Not ads free</li> <li>• Need to download and install it</li> </ul>

Paltalk Express	<ul style="list-style-type: none"> <li>• Be able to send invitation to Facebook/Twitter</li> <li>• Breakout rooms</li> <li>• Up to 200 groups</li> <li>• Integrate with Other IM tools</li> <li>• Statistic reports about group activities</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot upload multimedia files</li> <li>• No whiteboard</li> <li>• No screen and applications sharing</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No screen and applications sharing</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No screen and applications sharing</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No screen and applications sharing</li> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot upload multimedia files</li> <li>• No screen and applications sharing</li> <li>• No recording</li> <li>• No schedule functionality</li> </ul>	<ul style="list-style-type: none"> <li>• Not ads free</li> </ul>
Skype	<ul style="list-style-type: none"> <li>• 25 participants limit in an audio only group call and none need to have a paid account</li> <li>• Audio/video</li> <li>• File transferring</li> <li>• Chat</li> <li>• Manage chat history</li> </ul>	<ul style="list-style-type: none"> <li>• 10 participants limit in a video group call and one participant must have a Premium subscription</li> <li>• No recording</li> <li>• No whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No schedule functionality</li> </ul>	<ul style="list-style-type: none"> <li>• Need to download and install it</li> </ul>
ShowDocument	<ul style="list-style-type: none"> <li>• Recording up to 5 sessions</li> <li>• Chat</li> <li>• Whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• 3 participants limit</li> <li>• 30 minutes session duration</li> <li>• 10MB file storage</li> <li>• No Audio/Video</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• limited session duration</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• limited session duration</li> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• limited session duration</li> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• Not ads free</li> </ul>
VenueGen	<ul style="list-style-type: none"> <li>• Audio/video</li> <li>• Whiteboard</li> <li>• 3D immersion</li> <li>• Breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>• 3 participants limit</li> <li>• Only .flv and .swf files are unloadable and viewable</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No file transferring</li> <li>• No quizzes and polling</li> <li>• No screen and applications sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Be unable to send private message</li> <li>• No screen and applications sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Mac users need to download and install it</li> </ul>
Yugma	<ul style="list-style-type: none"> <li>• Polling</li> <li>• Recording and playback</li> <li>• Remote control</li> </ul>	<ul style="list-style-type: none"> <li>• 2 participants limit</li> <li>• 30 minutes session duration</li> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• limited session duration</li> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• limited session duration</li> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• Limited participants</li> <li>• limited session duration</li> <li>• No audio/video</li> </ul>	<ul style="list-style-type: none"> <li>• Have errors when send invitation to attendees</li> <li>• Need to download and install it</li> </ul>



Zipcast	<ul style="list-style-type: none"> <li>• Twitter and Facebook announcements built-in</li> <li>• Broadcast of audio, video and slides</li> <li>• Chat</li> <li>• Unlimited attendees</li> </ul>	<ul style="list-style-type: none"> <li>• No video</li> <li>• No recording</li> <li>• No screen and applications sharing</li> <li>• Even paid versions have limits for video uploads</li> </ul>	<ul style="list-style-type: none"> <li>• No video</li> <li>• No recording</li> <li>• No video uploads</li> </ul>	<ul style="list-style-type: none"> <li>• No schedule functionality</li> <li>• No video uploads</li> <li>• No recording</li> </ul>	<ul style="list-style-type: none"> <li>• No supported ways of playing back a session</li> <li>• No quizzes and polling</li> </ul>	<ul style="list-style-type: none"> <li>• Limited control for administration and moderation</li> <li>• No recording</li> <li>• No schedule functionality</li> <li>• No video uploads</li> </ul>	<ul style="list-style-type: none"> <li>• Need to have a SlideShare or Facebook account</li> </ul>
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## Appendix 7: An overview of 12 VCCS with a free trial version

VCCS Name	Advantages	Disadvantages in a specific use					Disadvantages in common requirements
		Training/Tutoring	Lecture presentation	Virtual meetings	Flexible learning experience	Flexible teaching approaches	
Virtual classroom & chat in LC (Blackboard Learn)	<ul style="list-style-type: none"> <li>Existing in LC</li> </ul>	Java plug-in does not work, having a problem of the collaboration server.					
Jigsaw meeting	<ul style="list-style-type: none"> <li>Screen/ Application sharing</li> <li>Recording</li> <li>Review multiple presentations</li> <li>Audio/Video</li> <li>Statistic reports</li> <li>Polling/survey</li> <li>Whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>Not breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>Not test because of the problem</li> </ul>	<ul style="list-style-type: none"> <li>Not test because of the problem</li> </ul>	<ul style="list-style-type: none"> <li>Attendees have to have an account</li> <li>No chat customisation</li> </ul>	<ul style="list-style-type: none"> <li>Not breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>Slow speed comparing to other applications</li> <li>It has errors after upload an image and a video file into the meeting</li> <li>No information about attendees limit</li> </ul>
Knoodle	<ul style="list-style-type: none"> <li>Live Chat</li> <li>Unlimited attendees</li> <li>Quizzes/survey</li> <li>“Play N’ Sync” interface</li> <li>Statistic reports</li> <li>Recording</li> <li>Built-in email tool</li> </ul>	<ul style="list-style-type: none"> <li>No whiteboard</li> <li>Be unable to see the attendee’ video</li> <li>Not support chat between attendees</li> </ul>	<ul style="list-style-type: none"> <li>No whiteboard</li> <li>No polling</li> </ul>	<ul style="list-style-type: none"> <li>No whiteboard</li> <li>Be unable to chat between attendees</li> </ul>	<ul style="list-style-type: none"> <li>No multiple language options</li> <li>Not support chat between attendees</li> </ul>	<ul style="list-style-type: none"> <li>No whiteboard</li> <li>No polling</li> <li>No Active Directory Integration</li> <li>No live session recording</li> </ul>	<ul style="list-style-type: none"> <li>No information about server platform and web browsers</li> </ul>
Mikogo	<ul style="list-style-type: none"> <li>Whiteboard</li> <li>Live chat</li> <li>Screen sharing</li> <li>Remote control</li> <li>Recording</li> <li>200MB file transferring</li> </ul>	<ul style="list-style-type: none"> <li>No breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>25 attendees limit</li> <li>No polling</li> </ul>	<ul style="list-style-type: none"> <li>25 attendees limit</li> <li>Some features are not for Mac users</li> </ul>	<ul style="list-style-type: none"> <li>Some features are not for Mac users</li> <li>On start of a meeting, only 15 minutes for the first participant to join else the session is terminated</li> </ul>	<ul style="list-style-type: none"> <li>Some features are not for Mac users</li> <li>No polling</li> </ul>	<ul style="list-style-type: none"> <li>Mac user cannot host virtual classroom</li> <li>It has matters of session indication</li> </ul>

Mindflash	<ul style="list-style-type: none"> <li>• 1000 participants</li> <li>• Quiz</li> <li>• Statistic reports</li> <li>• Record audio</li> </ul>	<ul style="list-style-type: none"> <li>• No live session recording</li> <li>• No live chat</li> </ul>	<ul style="list-style-type: none"> <li>• No live session recording</li> <li>• No live chat</li> </ul>	<ul style="list-style-type: none"> <li>• No live session recording</li> <li>• No live chat</li> </ul>	<ul style="list-style-type: none"> <li>• No live chat</li> </ul>	<ul style="list-style-type: none"> <li>• No user access controls</li> <li>• No live session recording</li> </ul>	<ul style="list-style-type: none"> <li>• No Synchronous virtual classroom</li> </ul>
OnSync	<ul style="list-style-type: none"> <li>• HD video</li> <li>• File sharing</li> <li>• Whiteboard</li> <li>• Scheduler</li> <li>• Screen sharing</li> <li>• Polling</li> <li>• Integrate with LMS</li> <li>• Remote control</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot set up groups</li> <li>• No recordings edit</li> <li>• No Quiz/survey</li> </ul>	<ul style="list-style-type: none"> <li>• 100 attendees limit</li> </ul>	<ul style="list-style-type: none"> <li>• No recordings edit</li> <li>• Cannot set up groups</li> </ul>	<ul style="list-style-type: none"> <li>• Only moderators can share screen</li> </ul>	<ul style="list-style-type: none"> <li>• No recordings edit</li> <li>• No Quiz/survey</li> <li>• Cannot set up groups</li> </ul>	<ul style="list-style-type: none"> <li>• It has matters of screen sharing</li> <li>• 100 recordings limit</li> </ul>
Saba central classroom	<ul style="list-style-type: none"> <li>• 500 attendees</li> <li>• Whiteboard</li> <li>• Recording</li> <li>• Survey</li> <li>• Screen sharing</li> </ul>	<ul style="list-style-type: none"> <li>• No breakout rooms</li> <li>• Cannot set up groups</li> <li>• No file transferring</li> <li>• No web tour</li> </ul>	<ul style="list-style-type: none"> <li>• No file transferring</li> </ul>	<ul style="list-style-type: none"> <li>• No file transferring</li> </ul>	<ul style="list-style-type: none"> <li>• Not support chat between attendees</li> <li>• No chat customisation</li> <li>• Attendees have to have an account</li> </ul>	<ul style="list-style-type: none"> <li>• No on-the-fly email</li> <li>• Cannot set up groups</li> <li>• No file transferring</li> </ul>	<ul style="list-style-type: none"> <li>• Not easy to search help resources on the website</li> </ul>
Twiddla	<ul style="list-style-type: none"> <li>• Support mathematical symbols and scientific notation</li> <li>• Whiteboard</li> <li>• File sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Not support chat between attendees</li> <li>• No recording</li> <li>• No webcam sharing</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No multimedia files playing</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No webcam sharing</li> </ul>	<ul style="list-style-type: none"> <li>• No chat customisation</li> <li>• No multimedia files playing</li> </ul>	<ul style="list-style-type: none"> <li>• No recording</li> <li>• No webcam sharing</li> <li>• No multimedia files playing</li> </ul>	<ul style="list-style-type: none"> <li>• It has matters of accessing websites by the web tour</li> <li>• 100 simultaneous meetings limit</li> </ul>
Yuuguu	<ul style="list-style-type: none"> <li>• Live chat</li> <li>• Screen sharing</li> <li>• Application sharing</li> <li>• Calendar integration</li> </ul>	<ul style="list-style-type: none"> <li>• No file transferring</li> <li>• No web tour</li> <li>• No slide show</li> <li>• No webcam sharing</li> <li>• No whiteboard</li> <li>• No polling/survey</li> <li>• No breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>• 30 attendees limit</li> <li>• No web tour</li> </ul>	<ul style="list-style-type: none"> <li>• No webcam sharing</li> <li>• No file transferring</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> <li>• No file transferring</li> </ul>	<ul style="list-style-type: none"> <li>• No reporting</li> <li>• No whiteboard</li> <li>• No file transferring</li> <li>• No polling/survey</li> <li>• No breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of help resources on the website</li> </ul>

VideoSeminarLive	<ul style="list-style-type: none"> <li>• Screen sharing</li> <li>• Recording</li> <li>• Polling</li> <li>• HD video</li> <li>• File sharing</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> <li>• Cannot set up groups</li> <li>• Cannot upload files in a live session</li> </ul>	<ul style="list-style-type: none"> <li>• 15-100 attendees monthly use</li> <li>• No whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> <li>• Cannot upload files in a live session</li> <li>• Live chat misses features</li> </ul>	<ul style="list-style-type: none"> <li>• Live chat misses features</li> <li>• Attendees need to download and install it</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> <li>• Cannot view attendees' profiles</li> <li>• No statistic reporting</li> <li>• Cannot upload files in a live session</li> </ul>	<ul style="list-style-type: none"> <li>• It has matters of sharing screen by participants</li> <li>• 50 hours of monthly recording</li> </ul>
Watchitoo	<ul style="list-style-type: none"> <li>• Whiteboard</li> <li>• HD video</li> <li>• Recording</li> <li>• Statistics reporting</li> <li>• Question area</li> <li>• Live chat</li> </ul>	<ul style="list-style-type: none"> <li>• No polling</li> <li>• Cannot set up groups</li> </ul>	<ul style="list-style-type: none"> <li>• 25 attendees limit</li> <li>• No polling</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• No whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>• No polling</li> <li>• No Quiz/survey</li> <li>• No breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of help resources about service security on the website</li> </ul>
WebEx	<ul style="list-style-type: none"> <li>• 1000 attendees</li> <li>• Whiteboard</li> <li>• Integrate with LMS</li> <li>• File sharing</li> <li>• Screen sharing</li> <li>• Remote control</li> </ul>	<ul style="list-style-type: none"> <li>• No polling</li> <li>• No breakout rooms</li> <li>• No chat customisation</li> </ul>	<ul style="list-style-type: none"> <li>• 25 attendees limit</li> <li>• No polling</li> </ul>	<ul style="list-style-type: none"> <li>• No chat customisation</li> </ul>	<ul style="list-style-type: none"> <li>• No chat customisation</li> </ul>	<ul style="list-style-type: none"> <li>• No polling</li> <li>• No Quiz/survey</li> <li>• No video streaming</li> <li>• No breakout rooms</li> </ul>	<ul style="list-style-type: none"> <li>• It has matters of hearing the sound of video files by participants</li> <li>• The meeting leader cannot be changed after the start of a meeting.</li> </ul>