

An Analysis of User Requirements for Virtual Classroom/Collaboration Software

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Abstract:

This article aims to present an analysis of user requirements for virtual classroom/collaboration software (VCCS) in learning and teaching. It collates and priorities existing user requirements in Cardiff University, reviews tools in the market, and recommends good tools that meet these requirements.

Keywords-component: virtual classroom, user requirements, learning activities

I. Introduction

Virtual Classroom is not a completely innovate term to educators. In the early 1990s, educators have started to see the value of computer-mediated communication (CMC), for instance, Hiltz and Turoff [1] described communication structures in their designed online environment for teaching and learning, named EIES 2. This could be seen as an example of the prototype of the virtual classroom using in distance education. In a recent study conducted by McBrien, Jones and Cheng [2], it discussed student-perceived strengths and weakness of using a synchronous online learning platform - Elluminate Live¹. The study concluded that most students had a positive online experience using synchronous learning technology but it closely related to how the instructors control communication and interaction over online classes on both technological aspects and pedagogical aspects.

It is hardly doubt that with the rapid improvement of information technologies, new trends continue to impact on Higher Education. For example, Howell, Williams and Lindsay [3] stated six trends: (1) the increasing percentage of adult learners and international students, (2) institutions are becoming more learner-centered, non-linear, and self-directed, (3) a huge growth in Internet usage and technological fluency, (4) lifelong learning is becoming a competitive necessity, (5) more courses, degrees, and universities are becoming available through distance-education programs, and (6) the growing needs for effective course-management systems and web services. Without exception, Cardiff University is one of the universities facing the impact too. The Learning Technology Team, Information Services in the university received increasingly requirements for supporting virtual classroom and collaboration software (VCCS) in 2012. This analysis therefore collated and clarified the user requirements for the VCCS in learning and teaching, reviewed VCCS in the market and further recommended good tools that meet the user requirements. To avoid misunderstanding of the topic, we provided a definition of Virtual Classroom:

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.

¹ Elluminate Live had been purchased by Blackboard Inc. in 2010 and is named as Blackboard Collaborate.

This article presents the conduction of this study and its findings. It intends to contribute to the knowledge of understanding user needs for the VCCS.

I. METHODS AND DATA COLLECTION

This analysis intended to gather opinion-related qualitative information rather than look to measure data quantitatively. Considering that a VCCS provides many features and it is time consuming to ask participant's opinion about each feature, an online questionnaire was designed to collect user requirements for functionalities of the VCCS. The questions about features of a VCCS were referred to two types of resources. One was the evaluation documents from the known application websites, such as Blackboard Collaboration generic vendor evaluation worksheet (e.g., [4]), Adobe Connect product comparison whitepapers [5] and TeamViewer benchmark ([6]). The other was the academic papers and research studies about the VCCS (e.g., [7], [8], [9]). The questionnaire covered most features relating to online educational activities. Table I shows an example of the designed questions for collecting user requirements. Figure I shows an example of questions in the survey. There were 14 categories in the "Teaching and Learning Feature" theme and 12 categories in the "Administration" theme.

TABLE I. AN EXAMPLE OF FEATURES IN VCCS

Themes	Categories	Features
Teaching and Learning Features	Live Video & Audio Streaming	<ul style="list-style-type: none"> • Test your audio locally • Adjust individual user volume • Audio/webcam setup wizard • Drag & Drop reordering • Play multimedia file (video, audio, Flash, QuickTime, mpg, m4v, etc.) • Play slides • Resize videos • Full Screen Video
	Capture/ record/ playback	<ul style="list-style-type: none"> • Moderators can control of sessions can be recorded, stored, exported or printed • Moderators can determine if a session/content can be accessed/ played back
Administration	Remote support	<ul style="list-style-type: none"> • Stand phone lines • VoIP • Installation required • Remote control
	Security	<ul style="list-style-type: none"> • Support SSL Encryption • Server software can be hosted securely behind a firewall

Following the online questionnaire, the participant was invited to a one-to-one semi-structured interview (40-60 minutes) to discuss more details of their requirements according to their responses to the questions in the survey. The interviewing questions were open-ended and aimed to collect background and extensive information related to particular requirements from the participant. It focused on the aspects as follows:

- To understand the participant's purposes of using 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 what are essential features of the VCCS for the participant;
- To know how urgent the requirement is for the VCCS is;

- To understand more specific subject-related requirements for the VCCS;
- To clarify any doubts about the questions in the survey;
- To give the participant an opportunity to interpret their requirements in detail.

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"/>

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"/>

Figure 1. An example of survey questions about user requirements for the VCCS features

Twenty-three faculties were invited to participate in this investigation by a recruiting email sending to domain administrators of the university e-learning system users. Fifteen volunteers from eleven faculties have participated in the study. Six out of fifteen participants have experience of using VCCS, and nine participants stated that they are planning to use a VCCS tool in learning and teaching activities.

The collection of available VCCS products in the market was based on four groups: (1) tools that we have already known, (2) tools recommended by e-learning professional interest groups and organizations (e.g., JISC funded projects [10]), (3) tools recommended in research papers and academic journal articles in education settings (e.g., [11], [12]), and (4) reliable awards for learning technology products (e.g., [13]). It included 46 VCCS tools on the list. Based on the availability, the VCCS products were categorized into three groups: 16 free register version tools, 17 free trial version tools and 9 commercial version tools. The nine commercial version tools were not tested because of one of the reasons: (1) did not provide a trial version, (2) requested to register credit card information to try a trial version, (3) requested certain membership.

The findings were based on evaluating tools in the group of free register version software and the group of free trial version software. The evaluation of the VCCS products is not comprehensive on the following aspects considering limitations of the availability of testing facilities, testing members and the investigation duration:

- Using mobile devices to access the VCCS was not tested;
- The VCCS 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 (over 10) synchronously joining in a live session was not tested.
- It did not test every feature of a VCCS product but focused on testing the features required by participants;

- Some VCCS applications (e.g., Voluxion <http://www.voluxion.com/>; Zoho Meeting <https://www.zoho.com/meeting/>) were dismissed because they either did not provide a free trial version or needed credit card information to register. It does not say this type of applications is not good.

II. FINDINGS

A. User requirements for the VCCS

The data showed that the participants have a positive view about the use of VCCS. Six key aspects of requirements relating to the use of the VCCS were emerged: (1) supporting online training and tutoring, (2) supporting online lecture presentation, (3) supporting virtual meetings, (4) enhancing flexible learning opportunities, (5) providing flexible teaching approaches, and (6) supporting subjects and special needs learners related e-learning. The core theory occurred here is *Flexible Learning*. According to Collis and Moonen [14], the theory is reflected on three dimensions from the data. At first, users required for flexible access learning content. Some participants mentioned that more and more students (including campus-based students) asked whether the teaching sessions could be available online for them to access later. Secondly, users expected flexible learning style regarding to time and location. Participants stated 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 e-learning systems to support online learning activities, and teaching staff want more flexible approaches to delivering e-learning courses. Without doubt, the requirements for the VCCS are learner-centered. People want a flexible learning environment cross the traditional classroom so that teaching and learning can fit into their lifestyle.

Figure 2 presents an overview of user requirements for the VCCS. It shows the main uses of the VCCS in schools/departments, the priority of the requirements in each use, and the fundamental features in relation to a use of the VCCS.

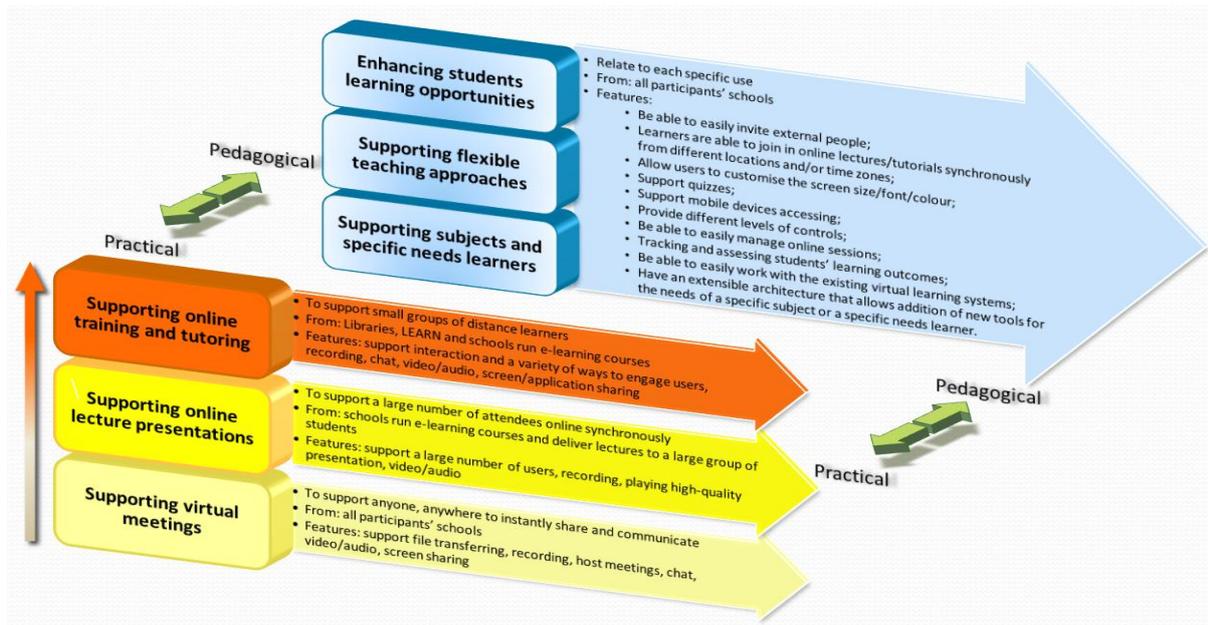


Figure 2. An overview of user requirements for the VCCS

There are three distinct requirements particularly in relation to learning and teaching activities. The first is supporting online training and tutoring. This is the most urgent requirement. This group of users was from libraries, the lifelong learning centre, and schools that run e-learning courses. The requirements represent on (1) having an easier approach for learners to join in a training session no matter their locations, (2) a live training session can be recorded by moderators, (3) recorded training sessions are accessible for learners, (4) the presenter is able to share screen and application, and (5) easily organizing group work or group discussions in a live session. This type of requirements was categorized according to common required 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 video);
- Supporting group work and discussions;
- One-to-one, one-to-many or many-to-many interactions (e.g., allow attendees to chat to each other).

Table 2 displays an example of the essential features in the VCCS if it is used for the purpose of supporting small group online training or tutoring (NB: the listed information is not integral). In the table, the first column refers to the key requirements stated by participants; the second column lists the functionalities in a VCCS tool; and the third column shows the category that we used to design the questionnaire (see Table I, the second column). The VCCS features such as supporting interaction and a variety of ways to engage users, recording, chat, video/audio, screen/application sharing are crucial.

TABLE II. AN EXAMPLE OF USER KEY REQUIREMENTS FOR THE VCCS IN THE USE OF SUPPORTING ONLINE TRAINING/TUTORING

Key requirements	Required VCCS features	Feature categories
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
Allow group work	Breakout rooms	Breakout rooms
	Whiteboard	Whiteboard
	Textual public messaging	Communication
	Textual private messaging	
	Audio/video	
File transfer	File transfer	
Be able to play multimedia files	Support various types of multimedia files	Live video & Audio streaming
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

Secondly, supporting online lecture presentations is a fairly urgent requirement. This group of users need the VCCS features such as supporting a large number of attendees connected synchronously, recording, playing high-quality presentations. It is related to the user who encountered 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. This group of users is from schools that run e-learning courses and that deliver lectures to a large group of students. In particular, the schools run e-learning courses to distance students need a better VCCS solution urgently. This type of requirements was categorized 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/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 interactions (in a lecture, it has little time for group discussions).

Thirdly, supporting virtual meetings was asked by participants too. The users expected the VCCS allows anyone, anywhere to share their desktop and ideas with others instantly. This use is not as urgent as the above two required uses. Features such as supporting file transferring, recording, host meetings, chat, video/audio, screen sharing are important. This type of requirements was categorized 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.

In addition to the above, there are three fundamental requirements at the pedagogical level. The three requirements are intrinsically linked in relation to the main uses of the VCCS. They are equally important in a use 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,

- The features allow students to attend a session from different locations and/or time zones,
- Allow students customise the screen size/font/colour,
- Online chat,
- Communicate through video/audio,
- Use whiteboard,
- Play quizzes, and
- Allow users to access from 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 an existing virtual learning system.

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

B. Reviewing of the VCCS

After reviewing thirty-three available tools in market, it found that three free VCCS applications: AnyMeeting (<http://www.anymeeting.com/>), TeamViewer (<http://www.teamviewer.com>), Wiggio (<http://wiggio.com/>) and five commercial applications: Adobe Connect (<http://www.adobe.com/uk/products/adobeconnect.html>), Blackboard Collaborate (<http://www.blackboard.com/platforms/collaborate/overview.aspx>), Microsoft Lync (<http://lync.microsoft.com/en-gb/launch/Pages/launch.aspx>), omNovia (<http://www.omnovia.com/>), WizIQ (<http://www.wiziq.com/>) meet most user requirements. In general, they are easy to use, run on all supported operating systems and web browsers, and provide reliable service and flexible features.

Considering to support online training and tutoring, all eight applications have "the 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.
- Wiggio has a problem of recording/playing back in the current free version.
- 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.

In relation to supporting online lecture presentations, AnyMeeting is the only free application that supports a large group of attendees (up to 200 attendees). Both Blackboard Collaborate and Microsoft Lync provide many required features. Blackboard Collaborate supports additional tools (e.g., complex mathematics symbols) and more types of multimedia files than Microsoft Lync.

In relation to supporting 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.

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. 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 customize 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 as supporting breakout rooms, supporting tracking reports and assessing students' learning outcomes, supporting extensible tools for specific needs learner and subjects, supporting multimedia file types, supporting multiple language interfaces, and providing a solution of integrating with the existing Learning Management System (LMS). Compared to Blackboard Collaborate, Microsoft Lync is a proper option for general collaborative requirements within an organization, but is not the best software option for supporting learning and teaching activities specifically. Figure 3 displays the recommended VCCS applications regarding to user requirements.

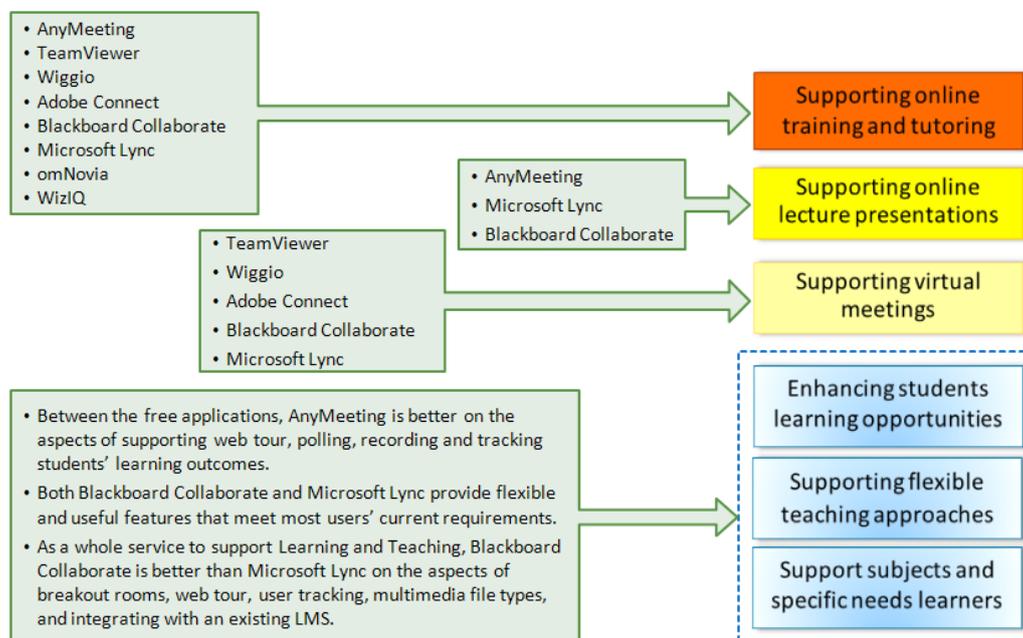


Figure 3. An overview of good VCCS tools and user requirements

III. CONCLUSIONS

It is apparent that no single application meets all user requirements. In accordance with different subjects and learning activities, there are different aspects and degrees of requirements for the VCCS features. One application may be more suitable than the other in relation to one or two particular requirements for the VCCS in the school. Based on the analysis, recommendations provided for users include:

- The users need to be aware that each tool has some weakness. When choose a VCCS application, they need to clear the most essential features in the VCCS in relation to their learning activities.
- In the short term, the schools that urgently need the VCCS (such as supporting tutorials or online trainings for a small group of distance students) should adopt a free application such as AnyMeeting until a centrally supported solution can be put in place.
- 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.
- 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 before a centrally supported solution is available.
- 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.
- Schools that have prepared funding for purchasing a VCCS tool should consider Blackboard Collaborate.
- Should any schools use Microsoft Lync or Blackboard Collaborate in the short term then their experience should be closely monitored to provide a comparison between the two applications.

Overall, it is hoped that this article helps people better understand the user requirements for the VCCS and further provides a sound in the support strategic decisions where it pertains to these technologies.

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