

Virtual-Classroom Free Software – The Comparative Analysis

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Abstract — In this paper the desirable features for web conferencing and virtual classroom software are established as relevant criteria for comparative analysis that is performed for the selected virtual-classroom free software.

Keywords — web conferencing, virtual classroom, synchronous e-learning, free software, LMS integration, comparative analysis, WizIQ, VMukti, Dimdim, Openmeetings, Vyew.

I. INTRODUCTION

WEB conferencing software, in its specific form of a virtual classroom, should provide online distance learning instructional process for integrated set of synchronous communication tools. These tools should regain the look-and-feel of a traditional classroom and face-to-face learning into the online distance learning environment, the feature also required by the accreditation standards for higher education distance learning study programs [1]. Virtual classroom software elements, carefully selected among available products from various vendors, and used properly on the basis of synchronous learning instructional theory, could even further improve traditional face-to-face classroom-based learning. These improvements are related to common benefits of information technology and digital multimedia usage, being for instance the possibilities for recording an entire conference session and playback it when necessary, as well as reusing capabilities and expressiveness enhancements of instructional content, achieved by deployment of digital multimedia templates, illustrations, animations, simulations and serious games activities in the so-called scenario-based learning [2].

In a virtual classroom, various communication channels are available for the live interaction between the participants and trainer. These involve voice, instant messaging, status icons, question & answer chat and webcam (optionally, for live video).

Many organizations work in a dispersed environment

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and traditional classroom training sessions may incur prohibitive travel costs and/or scheduling conflicts. Using a virtual classroom provides various benefits:

- Bring together participants from different geographical locations.
- No expenses for travel, hotel & training facilities.
- Suitable for training deliverables on short notice (i.e. short modules for a small topic).
- All types of digital media can be integrated (videos, podcasts, screen capture, animations, Powerpoint presentations etc).
- Interaction between participants & instructor via application sharing.
- Participants can work with software on systems that are not locally available.

Selecting the integrated set of tools when establishing a virtual classroom and considering all the relevant issues, could be rather a complex and tedious task, due to the number of existing e-learning technology vendors [3], [4], integration and localization issues, and the variations in their features. In addition to commercial vendors of web conferencing and virtual classroom software with approved quality of service and set of tools, like Adobe's Connect Pro or Elluminate's Elluminate Live!, as well as Citrix's GoToMeeting and GoToWebinar, there emerged their free and open source counterparts on the market as well. This paper is the research in a form of comparative analysis on the available features of web conferencing free software on the market. The desirable features for web conferencing and virtual classroom software are established as relevant criteria for this analysis in Section II. In Section III, free software solutions for virtual classroom are selected and compared regarding the relevant features specified.

II. THE DESIRABLE FEATURES AS RELEVANT CRITERIA

A. Common performance features

The basic notion of a virtual classroom (VC) is associated with existence of integrated set of tools for synchronous communication (usually text-based, in some form of **chat**) among all participants – learners and one or more presenters, as well as for **synchronous instructional content presentation** in oral and visual forms, controlled by presenters. This means that transition of slides, along with oral (audio) comments from the presenters, are performed live, in “real time” to all of concurrent learners. In some (even commercial) systems for web conferencing audio signal is obtained by simultaneous teleconference

(ongoing at the same time as web conference in question). Participants need to call regular conference phone calls and pay **extra fees** for them in order to obtain **audio presence** and sound from other conference participants.

Additionally, there could be a very diverse set of tools incorporated in this basic form of the virtual classroom environment. Nevertheless, certain tools to enhance VCs can still be referred to as standard ones according to current offer on the market.

In addition to standard **public chat** (messages viewable by all participants), **private chat** is also a common tool, allowing for exchange of messages being viewed among selected participants only.

A **video signal from presenter's web camera** has also become a standard feature of VCs, along with possibilities for seeing also the **signals from learner's webcams**.

A **list of participants** is common thing in this integrated set of tools, often along with **participant status indication tools** (for instance, enabling users to report about a completion of certain actions initiated by presenters).

A synchronous presentation should imply that there are possibilities for presenters to **upload and store content** for presentations in more or less structured form of a digital repository.

Another VC common tool is certainly a **whiteboard**, simulating the real-world one, allowing for live picturing of instructional content by presenters and learners as well, equipped with **highlighting (annotation and pointer) tools** (also applicable for the synchronous presentation content). Some improved auxiliary tools integrated into whiteboards include **math editors**, standard shapes, text tools, free form drawing etc.

Learners may also be allowed to **take over the presenter role**, namely highlighting and audio tools, to express their points of view or questions on a subject.

Although not so common, especially among free software tools, the **recording session** and repeated play features are very desirable, as key improvements to traditional face-to-face classroom-based learning. The feature also associated with entire conference session is the **session scheduling**. This feature is usually performed by automatically sending e-mail messages to predefined set of prospective participants, containing information about the subject, date and time of a meeting. Instructions regarding the way to access a session (usually the URL link), along with client system requirements – above all hardware and Internet connection specifications, but also software dependencies (add-ins) as well – often followed by the links to the connection test facility, are also included in such messages. Conference schedule data are also available at web site dedicated to the VC system.

Another useful tool integrated for getting feedback from participants is (synchronous) **poll**. During the conference itself, polls could offer insights into average previous and gained knowledge of participants, thus directing presenters' present and future instructional efforts, or into common thoughts and practices on a certain subject, even regarding the very ongoing conferencing session

performance and outcomes, as seen from participants' points of view.

B. Extra performance features

Apart from set of tools to perform successfully the very conferencing session, there are some extra features that need to be considered when selecting the most suitable VC system for certain needs.

If computer technology is expected to be extensively taught through VC utilities, an institution should consider a VC system incorporating **desktop sharing and control** facility. These tools usually require additional software add-ins and also suitable Internet connection upload speeds for smooth transfer (over 10 kB/sec) on the desktop presenter side. This means that either some reliable wireless Internet or ADSL connections with download speeds over 768 kbit/sec are needed (currently upload speeds are eight times slower than download speeds for ADSL connections in Serbia). Fortunately, there are free software desktop sharing and control utilities available [5]. Each vendor of free software VC system offering desktop sharing support recommends its favorite free software desktop sharing solution, but other solutions could be successfully applied as well.

Especially in educational institutions, VCs are just one of distance learning activities, being part of more general integration into the (educational) learning management systems – (e) LMSs, also called the virtual learning environment (VLE) or course management systems (CMS – not to be confused with web content management systems) [3]. LMS is a web based system that allows for the addition, deployment and tracking of learning content used for training purposes. Typically an LMS includes functionality for course catalogs (search/browse functionality), launching courses, registering new students, tracking current/completed student progress and assessments. Most of the learning management systems are developed to be independent of any content development/authoring packages. A corporate LMS usually does not incorporate any course authoring functionalities, but rather focuses on managing learning content. On the contrary, educational (institutions) LMSs (VLEs) usually integrate into “basic” (corporate context) LMSs more or less course authoring tools, along with a so-called learning content management system (LCMS). While LMSs mainly focuses on learners and record keeping, LCMSs manage the content of courses. Typically, course content is stored as learning objects in a learning object repository database. The objects are described and tagged so these objects can be recalled and reused by the same course designers and others. From the above descriptions it is obvious that many LMSs are taking on the features of LCMSs and vice-versa.

No matter the mutual differences and feature overlapping, the above-mentioned management systems require an **integration module** to integrate with VC systems, usually designed as independent systems regarding anticipated context of usage and technology to be applied. This integration module should associate

relevant (at least session scheduling) data from the systems to be integrated. If **signing in (and one signing up) is required for all VC participants** (not just for the presenters), the integration (and the entire VC session as well) is less smooth and intuitive, as well as more complex. The entire integration process is possible only if LMS supports modularity and VC system provides the public application programming interface (API). Since free software is considered in this analysis, the integration possibilities are considered for free open source VLEs (namely *Moodle* [6], *ATutor* [7] and *Sakai* [8]).

Having on the one hand VC software coming from mainly English-speaking countries, and on the other hand the requirements for teaching students in native and / or multiple languages, institutions often have to consider vendors supporting **internationalization, localization and customization** of user interface.

Other extra desirable features could refer to even wider utilization context of VC systems, including **social networking tools** for advertising and knowledge exchange, as well as **support for being paid by learners** for teaching services. While support for paid teaching services could be implemented elsewhere (on the LMS level, for instance), the VC with integrated social networking tools could really attract even more people, other than already enrolled students, thus certainly improving the reputation of a teacher and an institution as well.

C. Feasibility issues

There are two variants of free software VC implementation, namely as a *software* (i.e. complete software application, usually open source, is available and should be implemented entirely on the servers controlled by an institution itself, as “on-site”, “**in-house**” solution) and as a *service* (**hosted** solution – software is installed on proprietary web systems and its usage is free under certain limitations).

Open source software VCs to be implemented as in-house solution requires Internet connections with upload speeds of at least 1Mbit/sec and greater number of concurrent participants raises this limit further. Apart from educational institutions connected to the Academic network of Serbia, there are very few institutions being capable to reach sufficient Internet connection speed and hosting expertise to host their “in-house” solutions and thus control the entire system. Otherwise, an institution has to employ a commercial Web hosting provider. Open source software in-house solutions have unique set of software dependencies, being web applications built mainly in Java technology (namely Red5 open source Flash server [9]) and auxiliary applications out of the standard plan of Web hosting providers. That imposes more (about ten times) expensive so-called *virtual private server* (VPS) hosting plans and also more hosting expertise within an institution (an Internet provider provides suitable hardware, Internet connection, operating system and remote server administration utility only). Java technology cannot be considered as standard low-cost hosting plan.

There are very few (if any reliable) Java hosting providers in Serbia and there is at least one web hosting provider ([10]) offering Tomcat extensions for Java hosting on-demand for free, if paid for standard low-cost open source hosting plan (Linux & PHP & MySQL). Java hosting technology is very version-dependent (so specific versions of Java support are required for Java hosted web applications to be operational) and Java hosting providers are very reluctant in modifying their Java web server configuration.

Taking into consideration the above-mentioned in-house solution feasibility issues, the hosted service seems to be more (if not the only) acceptable solution for a great number of institutions in Serbia. The limitation on the number of participants is always imposed along with acceptable quality and features of virtual-classroom free hosted services. The selected solutions from the next section prove that limitation is not so restrictive that an institution would not be able to organize the instructional process accordingly.

III. VIRTUAL CLASSROOM FREE SOFTWARE

A. Selected free software for “in-house” implementation

The VC free software for “in-house” implementation is less available than the hosted service implementation. Nevertheless, there are at least three completely downloadable solutions that could be analyzed: *Dimdim* (version 3) [11], *Openmeetings* [12] and *VMukti* [13]. All of them have common features functionalities, can use MySQL open source database and support customization (branding). The first two of them are built on the same free open source software prerequisites, being Red5 Open source Flash server [9] and OpenOffice [14] PPT to Flash and PDF converter. The third one is built on .NET framework and is limited to be ported on the Windows IIS web server only and viewed by Internet Explorer 6 only, although it does not require any other software prerequisites (except a database). Features comparison of this software is performed in the Table 1.

TABLE 1: IN-HOUSE SOLUTIONS - FEATURES COMPARISON

| <i>Features</i> | <i>Dimdim</i> | <i>Openm</i> | <i>VMukti</i> |
|--------------------------|---------------|--------------|---------------|
| public / private chat | yes / yes | yes / no | yes / yes |
| video signals from all | yes | no | yes |
| user status indication | yes | no | yes |
| upload & store content | pdf, swf... | pdf, swf... | pdf, swf |
| whiteboard & annotat. | yes | yes | yes |
| math editor | yes | no | yes |
| learners as presenters | yes | yes, no | yes |
| session recording | yes | yes | yes |
| session scheduling | yes | yes | yes |
| polls | yes | yes | yes |
| localization (languages) | no | yes | no |
| paid teaching service | no | no | no |
| desktop sharing | built in | add. inst. | add. inst. |
| collaboration | yes | 4 us max | |
| learners need not log in | yes | yes | yes |

Although Openmeetings does not support private chat and session control by learners, sessions can be arranged as private rooms and 4x4 meetings (4 users when everyone speaks and views with each other) with whiteboard content shared among all users. Some users experienced echoes when used speakers instead of headphones and pretty excessive jitter when having five users and more. MS Office files and images could be uploaded and presented (converted on the fly to pdf or swf).

All of these products have integration module support for Moodle VLE [15]. Recently, Openmeetings integration with ATutor was created [12]. Being based on the same Java technology, Sakai has integrated reduced-featured virtual classroom module named Agora [8].

B. Selected VC free hosted services

The following VC free hosted service are selected: *WizIQ* [16], *Dimdim* (version 4 as hosted service) [11] and *Vyew* [17]. Their comparative features are listed in the Table 2. *Vyew* is the only one that still does not have any integration capabilities. None of these VC free hosted services has custom branding feature enabled.

TABLE 2: FREE HOSTED SERVICES - FEATURES COMPARISON

| Features | <i>Dimdim</i> | <i>WizIQ</i> | <i>Vyew</i> |
|--------------------------|---------------|--------------|-------------|
| max number of users | 20 | 50 | 20 |
| public / private chat | yes / yes | yes / no | yes / yes |
| video signals from all | yes | yes | yes |
| user status indication | yes | yes | yes |
| upload & store content | pdf, swf... | pdf, swf... | pdf, swf |
| whiteboard & annotat. | yes | yes | yes |
| math editor | yes | yes | yes |
| learners as presenters | yes | yes | yes |
| session recording | yes | yes | in devel. |
| session scheduling | yes | yes | yes |
| polls | yes | in devel. | yes |
| localization (languages) | no | no | no |
| paid teaching service | no | yes | no |
| desktop sharing | built in | add. inst. | built in |
| VLE integration | moodle | moodle | none |
| collaboration | yes | no | yes |
| learners need not log in | yes | no | yes |

WizIQ is the VC free hosted service with features of social networking regarding detailed data about teachers' competencies in the community, advertisement of their services and paid teaching service facilities and also offers the greatest number of maximum users allowed for free. Desktop sharing is very smooth and intuitive, integrated in the whiteboard, though additional desktop-sharing software install is required for a desktop presenter only.

Dimdim hosted version is very mature software product based on commercial secured resources, with great video, audio and desktop sharing fluency, and it is definitely a good solution for up to 20 users.

Vyew is still without some useful features like session recording and VLE integration (in development), but has a great potential in collaboration features, great math editor,

exam and polls, video, audio and desktop sharing, intermixing various file types in a single workbook etc.

IV. CONCLUSIVE REMARKS

This research has proved that virtual classroom free and open source software, implemented either as in-house or as hosted service, has emerged as considerable alternative to the commercial ones. Development is still very dynamic and improvements and new features are constantly performed. The dilemma is not: free or commercial software, but well-designed, efficient or ill-designed, unsuitable software. Sometimes relatively small additional fee could benefit a great improvement. The objective is to get the most in quality and desirable features for available budget and from the right balance between outsourced and internal services, and focus on human resources.

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