Bolstering Teaching through Online Tools

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ABSTRACT

This paper offers a compilation of technologies that provides either free or low-cost solutions to the challenges of teaching online courses. It presents various teaching methods the outlined tools and technologies can support, with emphasis on fit between these tools and the tasks they are meant to serve. In addition, it highlights various ethical, security and privacy considerations related to appropriate use of such tools. This integrated overview of various online teaching technologies can be easily leveraged to offer online as well as hybrid courses that are lively and more enriching to both the instructor and the students. Traditional in-person courses can also fruitfully use the tools and techniques mentioned in this paper to integrate recent innovations in online teaching technologies into the classroom.

Keywords: Web-based Learning, Online Teaching, Online Teaching Technologies, Pedagogy, Web 2.0

1. INTRODUCTION

The Internet has influenced many aspects of our lives, and the field of education is no exception. While some instructors have augmented their traditional face-to-face classes with various online components to better serve the learning needs of their students, many institutions offer online classes delivered completely on the Internet (Tallent-Runnels et al., 2006). Research shows that online classes can be as effective as traditional classroom-based courses when appropriate technologies are used and sufficient interactivity is present (Durrington et al., 2006). Implementation and proper utilization of available technologies, however, is a daunting task for two main reasons: (1) the instructor's limited knowledge of these technologies and (2) the apparent lack of many interactive features in the Web-based Learning Management Systems (LMSs) often used by universities to administer and deliver online courses (Dunlap and Lowenthal, 2009).

Instructors in traditional classrooms use a rich repertoire of teaching methods to impart knowledge to students. The primary methods used to facilitate learning in a class include lectures, class discussions, case scenarios, team projects, lab work, presentations, games and simulations. Traditional teaching methods invoke various levels of student participation, ranging from passive (e.g., listening to lectures) to active (e.g., participating in games). Instructors may vary their teaching methods to suit the learning objectives of the day. They may use lectures on one day, discussions on another day, and lab exercises or cooperative learning techniques on yet another day (McKeachie et al., 2006). Because students have different learning styles, a variety of teaching techniques can be used to appropriately target these learning styles (Nilson, 2003). Thus, diversity in

teaching approaches leads to unity among students' learning outcomes; this holds equally true for online courses (Mupinga et al., 2006).

Incorporating a richer set of teaching methods in an online course requires the use of diverse Web technologies—something which may often be difficult with a traditional LMS. Traditional LMSs primarily focus on centralized content creation and deployment of courseware by the instructor. There is a need to further facilitate communication, collaboration, and cooperation, both among students and between students and the instructor—which is the essence of the traditional classroom-based course. While the first-generation Web technologies (Web 1.0) which support traditional LMSs primarily rely on a one-way flow of information via "read-only" material available on the websites, the current generation of Web technologies (Web 2.0) tends to facilitate communication, information sharing, interoperability, and collaboration on the Web (Harris and Rea, 2009). Few universities have resources to upgrade an LMS to the latest version available in the market which may include newer interactive features. However, students of the current generation—often called millennials—are proficient in collaborative Web tools (e.g., Facebook, MySpace) and they expect the same level of capability from their online classes. According to the well-known "Task-Technology Fit" model (Goodhue and Thompson, 1995), there is a positive impact when capabilities of the technology match the tasks. Therefore, instructors need to match Web based tools with student learning needs to achieve proper learning benefits (Durrington et al., 2006). This puts the onus on the instructors to develop and deliver courses online that are rich in collaborative and interactive spirit, effectively utilizing the collaborative nature of the Web to replicate the traditional classroom-learning environment.

To address the above-mentioned challenges, this paper aims to: (1) provide an integrated list of free or low-cost tools and technologies that can enrich online classes; (2) classify the tools and technologies in a meaningful way for selection by instructors; (3) capture the fit between various teaching methods and the outlined Web tools and technologies; and (4) highlight the ethical, security and privacy considerations related to appropriate use of such technologies.

As the first step, we used our experience in using online teaching tools and reviewed existing literature to create a list of tools and technologies useful in online teaching. In order to make the list exhaustive, we also interviewed other instructors and experts to identify additional technologies. We next classified the technologies into various categories based on their functionalities. The technologies roughly fall under five categories: staging tools, course delivery, course collaboration, interactive communication, and learning assessment. Following Table 1 summarizes and classifies the tools based on their functionalities.

Effective incorporation and use of the technologies outlined in this paper will create an engaging environment that promotes joint learning in online courses. The concepts discussed here will not only help in developing online/hybrid courses but will also be useful in traditional face-to-face courses to enhance the learning environment. A further benefit is that many of the tools/technologies discussed in this paper are available at little or no cost to educational institutions that are often working under tightly constrained budgets.

The structure of this paper is as follows: The following section describes staging tools which provide basic online services for course management. It is followed by the sections on course delivery tools, collaboration tools, interactive communication tools, and tools for assessment of learning. A discussion of ethics, privacy, and security issues pertaining to the use of these tools follows. Finally, the paper's conclusion highlights the appropriate fit between teaching methods and the technology discussed in the article.

2. STAGING TOOLS: CREATING ONLINE COURSES

Staging tools are online teaching platforms that provide basic online services for course management. These Web-based systems allow better organization and delivery of traditional classroom-based courses to an online audience. Among other things, these systems are able to send emails, create discussion boards, share course material, administer tests, post announcements, and maintain grade books.

2.1 Learning Management Systems

Learning Management Systems (LMS), also known as Course Management Systems, are widely used staging tool for offering courses over the Internet. These basic building blocks provide support for instructors to better manage their courses on the Web in multiple ways and have been in vogue for more than a decade. They provide a secure environment

Category	Functionalities	Examples
Staging tools	Provides the basic structure to manage and deliver courses online.	Learning management systems/course management systems, online document management systems.
Course delivery tools	Enables the dissemination of course content in various forms.	Online videos, podcasts, news feeds, and screen capture.
Course collaboration tools	Allows collaboration between students, groups, and the instructor.	Blogs, wikis, collaborative document management systems.
Interactive communication tools	Facilitates rich communication between students and instructors.	Web conferencing, web based simulations.
Assessment and learning tools	Assists in gauging student learning against various objectives and benchmarks.	Testing tools, cheating prevention tools, plagiarism detection tools.

Table 1. Online Teaching Tools Classification

for creating and managing courses online and supply class rosters and grade books. Instructors can use them to create and administer assignments and/or exams. Communication and collaborating features such as e-mail, chat, and discussion boards may also be available in these systems.

Universities have quickly adopted LMSs in a short period of time (West et al., 2007). Although decisions regarding an LMS are generally made at the university level, academics need to be aware of available options to fully utilize and optimize these systems to achieve full potential. Both commercial and open-source LMSs are available. Commercial LMS vendors include Blackboard, Angel (recently acquired by Blackboard), and Desire2Learn. These vendors provide a suite of products that enables the management and delivery of online courses. Traditionally LMSs have been hosted on university servers, but recently many vendors have begun to offer managed-hosting services (where the system is deployed on vendor servers). This reduces upfront costs with universities paying a yearly fee for the hosting services. This type of arrangement eliminates the need for costly servers and the associated infrastructure; moreover, the vendor provides technical and help-desk support as well.

Open-source versions are an alternative to a commercial LMS (e.g., Moodle, Sakai). With universities on shoestring budgets, open-source options are gaining popularity. Proponents of open-source software applications argue that they are cheaper, more flexible, and better developed than closed-source competitors (Lawrence, 2009). Unlike commercial LMSs where the vendor provides support for the products, institutions using open-source LMS may get technical implementation and user support from third-party providers. Table 2 provides an illustrative list of various LMSs (both commercial and open-source) available.

2.2 Other Staging Tools

Another alternative is to totally bypass the LMS route and instead use a combination of readily available tools to create and manage online courses. These could include the instructor's own website, wikis, GoogleDocs and Google Groups. There are interesting experiments in using a portfolio of Google or Microsoft online offerings to put together a course-management system that can dispense with the need for a traditional LMS (Rienzo and Han, 2009).

2.3 Choosing s System

We have indicated three different options for acquiring the functionalities of an LMS. The final choice can be made based on the following considerations: In instances where the institution already has an LMS of choice, depending on the capabilities supported by its LMS in use, the instructor can utilize the tools mentioned in this article to compensate for any additional functionalities. In situations where the university does not mandate a particular LMS, the instructor can either opt for traditional LMS products or rely on online document-management systems such as GoogleDocs and MS Office Live to create the LMS like environment. Most of the time resource availability (i.e., financial, technical) may determine the choice of the staging tools. Opting for a commercial LMS may involve both hardware and software licenses costs. However, hosting open-source LMS products may require necessary server hardware and technical resources. While it is true that relying on online document-management systems is the least expensive way to offer online capabilities, it does require additional work on the part of the instructor to create some capabilities that are readily available in an LMS.

3. COURSE DELIVERY TOOLS

Delivery of the course content is one of the critical elements of any online instruction. Instructors rely on a variety of methods and materials to deliver course content such as lecture notes, slides, videos, and handouts.

Technology	URL	Research Papers/ Accessibility Specifics	Remarks
Learning Management Systems		(Hallam and Hallam, 2009; Hsui-Ping and Shihkuan, 2008)	Provide hosting/deployment support for other tools. Usually deployed at the university level.
Blackboard	Blackboard.com	Commercial	Major player in the LMS market.
Angel Learning	Angellearning.com	Commercial; demo available upon filling out a form	Provides a virtual world designed for educational experimentation within the popular Second Life application. Recently acquired by Blackboard Inc.
Desire2Learn	Desire2learn.com	Commercial	Apart from providing basic LMS, it also provides a suite of products, such as portfolios, to manage student performance
Moodle	Moodle.org	Open-source, Free	Used by many universities; typically used along with MySQL and PHP.
Sakai	Sakaiproject.org	Open-source, Free	Just like Moodle, provides free open-source competition to commercial LMS.
ILIAS	ilias.de	Open-source, Free	Developed first at the University of Cologne but now published as open source software.
Online Learning and Training	olat.org	Open-source, Free	University of Zurich developed this product and made it available as open source software

Table 2. Learning Management Systems

The course-related content itself could be instructor generated or supplied by the textbook publishers, but instructors can also rely on course-related content available from the Web to enhance their courses. Some of the Web technologies discussed here allows plugging into a vast array of resources to supplement the materials covered in the course.

3.1 Leveraging Online Videos

Online videos provide multiple ways to support lectures. Instructors often supplement their lectures with videos to present additional information about a topic. Many times they have to either purchase or borrow these videos as DVD or VHS cassettes. Availability of online videos has allowed instructors to easily include videos that may often be freely available. Moreover, instructor and student presentations can be hosted online for the class to access. Hence, online videos play a key role in facilitating teaching methods that involve audio-visual components.

In addition to deploying their own videos along with videos accompanying textbooks, instructors can connect students to the latest in their industry by tapping into the wealth of videos freely available online. For example, websites such as Youtube.com and Google Videos are good sources for videos related to various facets in a wide range of course topics. Some of these videos pertain to current developments in a topical area and can greatly extend knowledge gleaned from textbooks. These videos can be linked/embedded in either the Web pages maintained in the LMS or the instructor's website. Linking will simply take the viewer to the website containing the video. Embedding, on the other hand, will run the video within the course website. Usually online video websites give instructions on embedding/linking these videos. For instance, in Youtube.com, one can get the necessary programming code by clicking on the "more info" link on the particular video's Web page. Before linking or embedding a video, make sure to check for any copyright restrictions.

The aforementioned websites also provide an easy means for hosting instructor- or student-developed videos. Usually online video hosting requires special resources, such as a dedicated media server, that may be beyond the reach of many. To overcome this limitation, instructors can take advantage of the freely available server infrastructure of such commercial websites as Youtube.com or Google Videos to host and publish their course-related video content. There are also provisions available for making these videos available to only a select/invited group of students. For example, student team presentations in an online course could be hosted on Youtube.com and made available only to the students in the particular course (Green, 2008). Such student-generated videos can be showcased by the students to their prospective employers to provide a glimpse of their expertise. Table 3 provides a list of popular sources for online videos.

3.2 Connecting Students to the latest in the Industry

As an integral part of their work, instructors often communicate with their classes to inform students about course announcements and to share supplementary course materials. Conventionally, the instructor may maintain a website to post these announcements or send emails to the students. Posting of information on the Web requires the students to check the faculty's website often. Rich Site Summary/Really Simple Syndication (RSS) provides an easy way for the instructors to disseminate information about course supplementary materials and announcements.

To keep the students in touch with the latest in the industry, Web technologies such as RSS can be used to provide updated information to students. Many popular online news sources/websites, including BBC News and Yahoo!, offer RSS feeds. Feeds are automatic updates which allow anyone to easily receive updated content from any section of a site without having to visit the source (site). News from these sources can be made available to students in a couple of ways. The instructor's Web page can be modified by adding an extra programming code to incorporate news information from such feeds, and these news feeds can be automatically updated every few minutes/hours. Students can use special feed readers that may be either Web based (e.g., Google Reader, My Yahoo!) or desktop based (e.g., Firefox, MS Outlook) to subscribe to these feeds.

Instructors can publish their own course-related information through RSS so that students can automatically get the latest course announcements (Cong and Du, 2008). In addition, they can deliver information about assignments and related updates through RSS feeds directly to the students (Duffy and Bruns, 2006). These feeds dispense with the need for sending mass emails to students regarding any course

Technology	URL	Research Papers/ Accessibility Specifics	Remarks
Online Videos		(Clark and Stewart, 2007; Rosenbaum, 2008)	Online videos are quite popular. Instructors can supplements course audio-visuals with latest videos from the industry/business.
YouTube	Youtube.com	Free	It is a popular website for online videos. Affiliated with Google
Google Videos	Video.google.com	Free	Apart from having videos on its own, it also provides videos from other websites.
Yahoo Videos	Video.yahoo.com	Free	Comparable to Google Videos in functionality.

Table 3. Sources for Online Videos

Technology	URL	Accessibility Specifics	Remarks
RSS Readers			Delivers course-related as well as industry news.
MS Outlook	Microsoft.com/outlook	Commercial	Client needs to be installed.
Zimbra	Zimbra.com	Open-source	Web-based reader client.
Google Reader	Reader.google.com	Free	Web-based reader client
Live.com	Live.com	Free	Web-based reader client
RSS Feed Creators			Creates RSS feed content to deliver course related news.
Jitbit RSS Feed Creator	Jitbit.com	Commercial, trial version available	Creates the feed and allows us to transfer to any website to be hosted.
RSS Feed Creator	rssfeedcreator.sourceforge.net	Open-source product	Easy-to-use feed creator that creates the necessary XML file

Table 4. List of RSS Feed Readers and Creators

information. RSS feeds are created using Extensible Markup Language (XML); there are a number of tools available online which can be used to easily generate the necessary RSS feed file (see Table 4 for a listing of relevant tools). The feed file created using such tools could then be hosted on the instructor's website, and students would use one of the feed readers mentioned earlier to subscribe

3.3 Podcasting over the Internet

Lecture is one of the primary ways in which instructors convey course knowledge to students. Instructors often use slides/transparencies to support their instructions. Many instructors post these materials online for their students to use. Students can then review them at their convenience to better understand the concepts taught in the class. Instead of just posting lecture materials online, instructors can post the whole lecture audio/video itself. Online tools such as podcasts provide an easy way to accomplish that.

Podcasts are similar to RSS in the way students can subscribe to the feeds, but these differ in the type of content. Podcasts deliver audio/video files over the Internet for students to download. Students are familiar with podcasts since many already own devices to play them. Instructors can make course lectures available on demand in the form of either audio or video files. Free software tools are available to help in creating podcasts; they include Audacity for Windows and Garageband for Mac users. Created podcast files can be hosted free on websites such as www.ourmedia.org. Students subscribe to podcasts using tools like iTunes or Juice. Podcasts enable students to download and access class information anytime from anywhere. Podcasts can transform the way students are engaged in learning (Beldarrain, 2006). Some universities including UC-Berkeley already make their courseware available through podcasts. Table 5 provides an illustrative list of podcast creators and subscribers.

3.4 Capturing Software application Screens

Some of the courses may require students to use software tools such as Statistics Data Analysis Packages or Integrated Development Environments. In such instances, the use of these tools is an integral part of the course itself. In a traditional classroom, the instructors can provide in-person demonstrations on how to use the software. In some courses, the instructor may also have specific lab sessions to teach the use of such tools. In an online course environment, however, it is often difficult to do these things.

Technology	URL	Research Papers/ Accessibility Specifics	Remarks
Podcast Creators		(Bahr, 2006; Castelluccio, 2006)	Popularity of podcasts among students can be leveraged to deliver lecture /discussion audio files.
Garageband	garageband.com	Free MP3 hosting	Largely related to music.
Nuendo	Nuendo.com	Commercial	Good for creating quality podcasts.
Audacity	audacity.sourceforge.net	Free MP3 and wav file creation	Useful to create podcasts in multiple formats.
Podcast Subscribers			Used to subscribe course related podcasts that can be played on music players.
iTunes	apple.com/iTunes	Free software	Can be used to listen to lectures.
Juice	Juicereceiver.sourceforge.net	Free	A "media aggregator," program that allows download audio files from anywhere on the Internet.

Table 5. List of Podcast Creators and Subscribers

Technology	URL	Accessibility Specifics	Remarks
Screen Capture			Allows the video capture of software application screens.
Screencam	smartguyz.com	Commercial, trial version available	Appropriate in displaying work on a computer. May require microphone.
Camtasia	techsmith.com	Commercial, trial version available	Appropriate in displaying work on a computer.
CamStudio	camstudio.org	Open-source, Free	Streaming video software.
iSpring	ispringsolutions.com	Commercial, trial version available	Converts slides to flash videos and provides option for adding voice.

Table 6. List of Screen Capture Tools

To overcome this shortcoming, there are tools available to create small videos that capture the computer desktop screen along with the instructor's voice while the task is executed. ScreenCam, Camtasia, CamStudio and iSpring are some of the tools that allow the instructor to create such videos. For example, these tools can be used in teaching computer programming. The instructor can create videos to show different steps involved in program development (Watkins and Hufnagel, 2007). Students can then play the videos to see how specific tasks can be accomplished in a particular software application. This approach greatly simplifies teaching programming languages and eliminates the need to create/share lengthy software manuals. Table 6 provides a list of available screen-capture tools.

4. COLLABORATION TOOLS

The Web fosters innovative ways to make classes more interactive and help students learn from each other. While traditional LMSs provide facilities for discussion boards, chat applications, calendaring, and emails, instructors can also utilize the following tools to create an even more collaborative class environment.

4.1 Expressing Views and Opinions

Instructors and students often discuss topics of interest in their classes. Discussions provide a way for productively exchanging ideas and thoughts. Instructors may also use the case study method to allow students to critically think and analyze business problems in a classroom environment. Instructors usually assign cases to groups/individuals and allow them to present in class. Students also participate in discussions based on the assigned cases. The online environment provides both synchronous and asynchronous ways to express views and opinions and carryout discussions. Blogs are asynchronous tools that allow students and faculty to participate in discussions without being online at the same time.

Blogs (or Weblogs) are particularly good for posting thoughts and announcements in a chronological way. Typically, in blogging websites, authors post their views or thoughts; postings are displayed in chronological order with the most recent shown on top. Blogs offer several useful features: Readers can subscribe and be notified of any new postings by the author; blog entries are normally followed by a comment section, where readers can leave their opinions and also interact with each other; and blogs can also contain multimedia content. Instructors as well as students can maintain blogs to support the purposes of any given course. Some of the LMSs—Blackboard, for instance—provide a means to host blogs. Outside blog providers such as blogger.com are another option. Blogs are useful in engaging students in discussion, exploration, and discovery (Glogoff, 2005), and students who subscribe to blogs get frequent updates. Twitter is a tool for micro-blogging (i.e., with posts limited to 140 words) where a short text is posted and instantaneously sent to subscribers via a website, SMS or another application. It can also be used to enhance social presence in online courses (Dunlap and Lowenthal, 2009). Table 7 presents a list of blog providers.

4.2 Collaboration in the creation of Documents and Web Content

Many courses today involve some level of team or group project work. In these projects, students work together in teams to create reports or papers.

Technology	URL	Research Papers/ Accessibility Specifics	Remarks
Blogs		(Lai-Chen and Ching-Long, 2008; Schultz, 2005)	Enhances communication between students and the instructors.
Blogger	Blogger.com	Free to use	Easy to use
WordPress	Wordpress.com	Free to use	Easy to use
TypePad	Typepad.com	Trial version available	Easy to use
Twitter	Twitter.com	Free to use	Part social-networking part micro-blogging tool.

Table 7. List of Blog Providers

In these projects, students work together in teams to create reports or papers. Group projects provide an avenue for cooperative learning and an opportunity for students to learn team dynamics. The power of the Internet can be utilized in a number of ways to facilitate collaborative work. Subsequent paragraphs discuss collaborative document-management systems and wikis that enable joint production of documents.

4.2.1 Collaborative document-management system: Many Web-based systems allow for the creation and maintenance of documents on the Web in a collaborative way. They have many advantages over traditional personal-productivity tools such as word processors, and spreadsheets. Word processors such as MS Word provide features for creating group project deliverables. Though these word processors provide facilities to track changes to documents, they assume the sequential editing of the document. Additionally they do not allow concurrent use of the same document by different users. For a true online collaborative learning environment, simultaneous access to the document for many users is a must. Although it may be necessary to save different versions of the document with details about who made which changes, MS SharePoint and GoogleDocs provide ways to do this. The system maintains versions of the document as well as data about the changes and the person who has made the changes. These changes can then be accepted or rejected. Although these tools have many of the functionalities of traditional productivity tools, they may lack some of their formatting and other sophisticated features. It is pertinent to mention that such formatting can be done at the end, and these tools come in handy while creating a group term/research paper or a group project report more efficiently and effectively.

4.2.2 Wikis: Wikis are server-based software that allows users to freely create and edit the content on a Web page. One challenge of an online class environment is the lack of opportunity for students to learn from one another. Wikis enable students to jointly and democratically produce a product (e.g., term paper, research project) by providing a shared environment in which to create and maintain Web pages. They foster two-way knowledge flow between instructors and students and present an opportunity for students to engage in knowledge-creation activities (Watson et al., 2008). Wikis also facilitate problem solving in a group environment that encourages shared ideas, dialog, interaction, decision-making, and presentation (Hazari et al., 2009). Wikis are published on the Web; they allow different versions of a document to be maintained, and they show editing done by different people on the same document. This also enables keeping track of incremental contributions by each member of the group (Kane and Fichman, 2009). Free wiki tools such as Wikispaces and PBWiki are useful in developing wiki-based projects. The collaborative environment supported by wikis can foster a superior learning environment (Mindel and Verma, 2006; Watson et al., 2008).

These technologies can be used based on the unique requirements of the course. For instance, if the collaborative work involves the use of spreadsheets or presentation tools, then a collaborative document-management system may be a better choice since wikis may not provide those capabilities. If the collaborative work requires only the creation of textual documents, then wikis may be better suited, especially when a large group of people is involved in the project and no individual takes ownership of the output. Group projects can also be conducted and tracked using online project management tools (e.g., Zoho Projects). Apart from providing communication/collaboration facilities, these tools allow groups to assign tasks to individuals and then track their progress with the schedules and deadlines. Table 8 provides a list of various collaborative document-creation tools.

5. INTERACTIVE COMMUNICATION TOOLS

While the above-mentioned tools have a tendency towards either delivery or collaboration, some tools provide both delivery and collaboration facilities.

Technology	URL	Accessibility Specifics	Remarks
Collaborative Document Management System			Web based document management system that allows creation and sharing on document in a collaborative way.
GoogleDocs	Docs.google.com	Available free with Gmail account.	Spreadsheets, word processors and presentation tools available.
MS Office Live	Officelive.com	Free	Free online storage and document sharing.
Zoho	Zoho.com	Limited version free with registration	Built in project management capability. Free 1 GB space.
Wikis			Permits knowledge sharing and allows joint output.
Wikispaces	Wikispaces.com	Free limited version	Provides specific solution for classrooms.
PBworks	Pbworks.com	Free limited version	Provides specific solution for classrooms.

Table 8. List of Collaborative Document Creation Tools

Technology	URL	Accessibility Specifics	Remarks
Web Conference			Real-time video conferencing and desktop sharing.
Wimba	Wimba.com	Commercial	Usually deployed at the university level; integrates seamlessly with LMSs such as Blackboard and Moodle.
Elluminate	Elluminate.com	Commercial	Elluminate Bridge allows for integration with Blackboard LMS.
WebEx	Webex.com	Commercial, with limited-time trial version free with registration	Combines real-time desktop sharing with phone conferencing so everyone sees the same thing as you talk.
DimDim	Dimdim.com	Free, Open-source edition available	Browser-based service that allows sharing of desktop, slides, as well as chat, and broadcast via Webcam.
Adobe Connect	adobe.com/products/acrobatconnectpro	Free trial available	Allows sharing of presentations, web conferencing and user desktop.

Table 9. List of Web Conferencing Systems

5.1 Conferencing on the Web

Live presentations and discussions can enhance student learning and force active participation by each student. Live presentations incorporate both verbal and non-verbal communication forms. Though traditional classes rely on such presentations, incorporating the same in an online environment requires some special tools and considerations. Audio and video podcasts allow for presentations but they are neither real-time nor live. Webcasting, on the other hand, provides a way to incorporate live presentations (Shim et al., 2007). Though Webcasting is basically a one-way communication (from the instructor to the students) tool, it can also allow for limited interaction with the presenters. Using Webcasting techniques, instructors can give lectures as well as invite other experts to provide presentations from anywhere in the world.

Conducting a live presentation/conference requires special considerations. Some universities rely on additional programs (Wimba and Elluminate are two examples) that seamlessly integrate with a traditional LMS such as Blackboard to conduct Web conferences. Again, deploying these additional software applications may require extra investments. One primary benefit with these tools is their easy integration with the LMS, thereby eliminating the need for separate user ids and passwords for logging in to the Web conference.

Fee-based hosted Web conferencing applications, such as Microsoft Office Live Meeting and Cisco's WebEx, and open-source software applications like Dimdim are alternatives to LMS add-on programs. While all of these tools connect and engage students in online meetings, additional capabilities vary; they may include the ability to share desktop screens, whiteboards, and chat. Using these features, the instructor can broadcast lectures and notes, receive student responses, and answer student questions all in real time. Students having problems with their computers can allow others to troubleshoot and resolve the problems through desktop sharing. Chats through instant messengers can also facilitate holding virtual office hours (Li and Pitts, 2009). Table 9 provides a list of various Web-conferencing tools available in the market.

5.2 Web-based Simulations

Simulations and role-playing techniques are effective teaching methods that supplement lecture based learning in the classroom. These non-lecture based teaching techniques greatly enhance student engagement in the classroom and make students active participants in the learning process. Incorporating such non-lecture based teaching techniques in an online environment requires additional tools. In recent years, Web-based simulation games have become popular for providing experiential learning to students. With easy access, immediate feedback, and depiction of various situations as text or animation, online simulation can be a powerful educational tool. Robbins and Butler (2009) classify them into (a) training simulations, (b) educational games, (c) learning communities, and (d) virtual situations. These tools offer various learning benefits to the students. There are general-purpose simulations as well as specific simulations available.

SecondLife is one example of a general-purpose simulation which can be used to create realistic scenarios that allow students and instructors to work together and brainstorm solutions to challenges, as well as create solutions and test them within a virtual-world economy (Harris and Rea, 2009). Instructors can also use SecondLife for role-playing, simulations, exploration, and experimentation that can be tried out in a relatively risk-free environment (Graves, 2008). Using the philosophy of learner-centered teaching, Schiller (2009) designed a SecondLife Project to engage students in an active learning environment. De Lucia et al. (2008) used SecondLife to foster collaborative group learning methods used to enhance student learning.

A special-purpose simulation made available by IBM, called INNOV8, allows students to bring together Information Technology and Business Processing Modeling

Technology	URL	Accessibility Specifics	Remarks
Simulation tools			Allows experiential learning environment where students play an active role.
Littlefield	littlefield.responsive.net	Commercial but trial available.	Factory simulator that allows students to compete with each other while learning operations management skills.
INNOV8	ibm.com/innov8	Free with online registration.	Business Process Management (BPM) simulation, gives both IT and business students a better understanding of how effective BPM affects an entire business.
Secondlife	secondlife.com	Free with online registration.	General purpose simulation tool useful for role-playing, simulations, exploration, and experimentation in a relatively risk-free environment.

Table 10. Web-based Simulation Tools

concepts, apply them in a simulated environment, and test the effects. Robbins and Butler (2009) articulate how these simulations and virtual worlds can be used in teaching a number of Information Systems concepts, such as requirements gathering, understanding how IS impacts business objectives, identifying uses for new technologies, and managing IT projects. The Littlefield Web-based factory simulator even allows students to compete with each other over the Web while developing operations management skills (Miyaoka, 2005). Use of such tools helps students to gain real-life practical experience in an online environment. Table 10 provides a list of various Web-based simulation tools available in the market.

6. ASSESSMENT OF LEARNING

Measuring the learning outcomes of students is an essential part of teaching. Assessment for learning refers to monitoring students' performance against targets or objectives (Hargreaves, 2005). Traditionally educators rely on various measures to gauge the student's learning from a course. Some of the mechanisms used for assessment in online environment are exams, assignments, and class participation (Rovai, 2000).

6.1 Exams/Tests

In general, exams/tests are used to ascertain student learning in a course. Administering exams online poses special challenges. Both generic LMS as well as independent testing websites offer provisions for administering exams. Table 11 outlines some of the tools that help in creating and administering exams. Textbook publishers usually supply test banks with various types of questions; these tests banks can be directly imported into these online testing environments.

One of the challenges in the online environment for testing is the difficulty in conducting personally proctored exams. Technologies provide many ways to reduce the issues associated with the lack of proctors. Some of the online tools provide ways for allowing students to take exams in a controlled environment such as a computer lab. These techniques utilize a computer's Internet address to prevent students from taking exams from outside the lab computers (e.g., SAM Central). Testing tools in some of the LMS (e.g., Blackboard) prevent students from navigating to other parts of the LMS during the test. Tools like "Remote Proctor" authenticate the student through biometrics and allow for the use of Web cams for capturing student's activities during test taking (Meine and Dunn, 2009).

6.2 Assignment and Group Projects

Instructors also use assignments and group projects for assessing different learning objectives. One of the challenges for instructor in grading these submissions is the issue of plagiarism. Tools presented in Table 11 effortlessly allow the instructor to check whether the submission is original or plagiarized from other online sources. Again, these tools may involve additional subscription expenses for the instructor. Sometimes the university itself may have licensing agreements with the plagiarism checking tool providers and that may simplify the use of these tools in the class.

6.3 Class Participation

Some of the teaching techniques such as lecture, group discussion, and teaching case analysis require active participation of the students. Instructors can use a variety of ways to check student participation. For tasks that use an LMS, activity-tracking features provide the necessary mechanisms for checking class participation. Student participation in blogs and wikis are self-evident, since the content will be marked with the student names/identifiers. A collaborative document management system such as Google docs and wikis also provide an editorial history of a particular document, and they are of great use in checking student participation. Web conference and chat tools provide chat logs and help in accounting for student participation during class discussions. Instructors can evolve a grading rubric that allows the awarding of points for class participation. Rovai (2000) provides an illustrative rubric for grading online discussions that considers both quantity and quality of student participation to award grades.

Technology	URL	Accessibility Specifics	Remarks
Testing tools			Students can be tested on concepts/skills online.
ClassMarker	classmarker.com	Commercial, free testing is also available.	Administers online test for both class based as well as external testing resources.
Various LMSs			Traditional LMS discussed earlier provide testing tools.
GoogleDocs	docs.google.com	Free as well as paid service	Spreadsheets can be used for simple tests that do not require any security mechanisms.
SAM	cengage.com/samcentral	Commercial	Students can be tested on both concepts as well as skills in MS Office products.
Cheating prevention			Special tools that prevent cheating in exams.
Remote Proctor	remoteproctor.com	Commercial	Enables students to take exams anywhere, while providing integrity as found in a proctored classroom. It includes camera, biometric scanner, and microphone, which are purchased by students (Meine and Dunn, 2009).
Plagiarism Detection			Tools that detect plagiarism issues related to student submissions.
Turnitin	turnitin.com	Commercial	Useful in checking written work for improper citation or misappropriated content. Can be used with LMSs as an add-on.
SafeAssign	safeassign.com	Commercial	Comes as a standard component in certain LMSs.
PlagiarismDetect	plagiarismdetect.com	Commercial and free version	Offers various services in plagiarism detection.

Table 11. List of Assessment Tools

7. ETHICS, PRIVACY, AND SECURITY

The tools discussed in this paper can greatly enhance student learning experience. However, unique set of challenges related to ethics, security and privacy in online environment necessitates the need for instructors to be cognizant of these issues surrounding the use of teaching tools in online environment.

7.1 Ethics

There are many ethical issues surrounding some of the techniques discussed in this review. First, the instructors should ensure that the online videos being used in their classes are not pirated and do not infringe on copyright rules. Second, when creating podcasts, it is imperative that appropriate credit be given to the source of any quoted text (same is the case for blogs/wikis). Moreover, publishers of the quoted text may require special permissions when the quoted text is likely to exceed the principle of fair use. Third, wikis and blogs used by students in the course should adhere to general Internet netiquette and any required wiki-specific netiquette. Finally, if desired, instructors can also obtain copyright protection for their own original podcasts.

7.2 Privacy

In general, using the Web comes with concerns of risks related to privacy. The same holds true for online teaching. Many of the tools discussed in this article utilize services hosted by other providers (e.g., Google, YouTube). These providers have their own privacy policies and instructors need to be aware of these policies, as any course-related content posted on external websites will be governed by them. This may include such things as controlling access to the content and determining how long the content will be retained. Some tools may also require students and instructors to register before using them (e.g., Google for GoogleDocs), and the registration process may require personal data about the users. However, this may not be a big limitation as the required information is quite similar to what is typically asked when opening free email accounts like Hotmail and Gmail. Privacy is a pertinent issue with regard to the use of Web cam based conferencing systems if used in the course. This may pose difficulty in case some students do not want to participate due to privacy issues. Instructors need to take this concern into account and, if required, make alternate mechanisms, such as text-based chat, available to elicit the participation of these students.

Grades as well as other information, such as student contact details, may come under the purview of the Family Educational Rights and Privacy Act and other university policies. Therefore, instructors need to be careful while disseminating work done by students and should take students' consent before publishing their material on public domains like YouTube, etc., or even on LMS's for the class

to see. We also suggest instructors to avoid posting grade-related information on their blogs, websites or through the other tools discussed in this article. Posting grades and feedback should be limited to secure channels like university email systems.

7.3 Security

Security is another important consideration when teaching in the Web environment. Students can be encouraged to protect their identity by creating course-specific names and identifiers for use with tools discussed in this article (e.g., blogs, wikis, and Web conferences). Moreover, some of these tools that are discussed have their own security mechanisms over which instructors have limited control (e.g., Google for GoogleDocs). Some of the tools mentioned may in addition, require installation of special software or plug-ins (e.g., MS Office Live). Instructors should confirm the reputation of vendors of such plug-ins, and ensure that there are no spyware in the software.

8. CONCLUSIONS

While there are numerous tools and technologies available, it is imperative to achieve a good fit between task and technology when teaching online courses. This article discussed various tools available for teaching and appropriate teaching methods for these tools. Table 12 provides a snapshot of various teaching tasks and the corresponding technologies mentioned in this article. It also articulates the fit between the teaching method and appropriate tools. When planning for an online course, instructors can refer to this table to look for technologies that fit their task.

While LMSs have basic features available for supporting online courses, they lack the level of sophistication that is possible using current-generation Web tools. The last decade saw the emergence of many advanced Web technologies that foster a social and collaborative

Task	Description	Useful Tools/Purpose	
Lecture	Traditional teaching method primarily used to deliver content. Supplemental audio-visual aids for lectures may also be used.	Learning Management System	Distribute slides and class notes
		Podcast	Audio/video files of lecture
		Online Videos	Course-related videos
		RSS	Class announcements
Class discussions	Promote productive exchange of viewpoints and also help in the transfer of knowledge to new situations (Nilson, 2003).	Web conference	Synchronous discussions
		Blogs	Asynchronous discussions
Teaching cases	Helps in the development of student ability to solve problems using knowledge concepts and skills relevant to a course (McKeachie et al., 2006).	Web conference	Synchronous case analysis
		Blogs	Asynchronous discussion of cases
Team projects/ paper	Enable group learning and require the creation of joint output.	Collaborative document management system	Simultaneously creates and edits documents
		Wikis	Simultaneously creates and edits Web pages
Lab-based instruction	Permits learners to experience a phenomenon (McKeachie et al., 2006). IS courses often involve such instruction.	Screen capture	How-to screen shots of computer-based exercises
Presentation	Student presentation on select topics. Group presentation may also result from group projects.	Web conference	Real-time presentation while sharing slides.
		Online videos	Asynchronous presentation video made by students.
Games and simulations	Experimental learning technique that allows students to learn by experience (Nilson, 2003).	Various websites and software	A popular technique in some classes that involve role-playing techniques.
Assessment of learning	Instructors use various tools for accessing student learning. Some of the methods include tests and exams, assignments and student class participation.	Testing tools	Testing/proctoring tools can allow exams to be administered without worry of cheating.
		Assignments and group projects	Plagiarism detection tools can help in checking the submissions.
		Class participation	Tools that allow tracking student class participation.

Table 12. Teaching Method and Suitable Tools

online environment. Current-generation students are well versed in these social and collaborative Web technologies. Although upcoming releases of LMS products can provide enhanced functionalities, the current downturn in the economy is also forcing institutions to control their expenses and look for options without sacrificing the quality of education. In addition, in some institutions, LMSs are not even available. Against this backdrop, it is imperative that a diverse set of online tools be utilized to enhance their course offerings. Although there are a variety of articles on individual Web technologies for online teaching, this paper provides an integrated, holistic view of these technologies and proposes various contexts in which these can be fruitfully synergized.

It is pertinent to mention that various tools discussed in the article are useful, easy to use, and at times, free of cost. However, instructors should also evaluate the appropriateness of these tools/techniques to fit their unique teaching situations. Depending on the teaching environment, instructors can choose from among the above mentioned technologies to create a unique set of tools to cater to their classes. Apart from finding a good fit, instructors need to evaluate the trade-offs between the costs of developing such course components and the potential educational benefits. Based on their level of expertise, instructors could either implement several tools at once or take a gradual incremental approach when experimenting with new tools. Obviously there are some limitations of the paper. The technologies used in the field of online education are vast, and ever growing. Therefore while this paper has an exhaustive compilation of online technologies, recently introduced technologies may have been overlooked. The paper presents a good snapshot of the current market. It is true that the technology landscape often changes due to the advent of new tools and technologies. The current study could be replicated in the future to update the changes in the technology landscape. Future studies can extend this work by conducting detailed comparison of various tools in each category.

This paper contributes to online pedagogy by providing guidance in selecting and effectively utilizing appropriate online tools for bolstering teaching. It also elucidates the ways by which the instructors can utilize technology options to harness the full potential of teaching tasks/methods and make online classes more dynamic and richer. The tools and techniques discussed in this article can be effectively used to provide students a rich and useful learning experience.

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