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Innovative Technologies for Education and Learning:
Education and Knowledge-Oriented Applications of Blogs, Wikis, Podcasts, and More

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ABSTRACT

A number of new communications technologies have emerged in recent years that have been largely regarded and intended for personal and recreational use. However, these "conversational technologies" and "constructivist learning tools," coupled with the power and reach of the Internet, have made them viable choices for both educational learning and knowledge-oriented applications. The technologies given attention in this article include instant messaging (IM), Weblogs (blogs), wikis, and podcasts. A discussion of the technologies and uses, underlying educational and cognitive psychology theories, and also applications for education and the management of knowledge, are examined in detail. The implications for education, as well as areas for future research are also explored.

Keywords: *conversational technologies; education; knowledge; knowledge management; learning; innovation; Internet; instant messaging; podcast; Weblog; wiki; podcast*

INTRODUCTION

For many years, the mediums employed for education have remained fairly constant and traditional: tried and true methods such as the blackboard and chalk, whiteboards, flipcharts, and overhead projectors. The employment of computing technologies has resulted in the use of PowerPoint, e-mail, and Web-based course portals/enhancements such as Blackboard and WebCT.

There have been numerous studies done, and papers written, about the use of technology in the classroom, together with work on the related areas of e-learning, Web-based learning, and online learning. The usage of computing technologies in education has been examined in numerous studies, and there is a sizable body of work on Web and online learning, including the studies by Ahn, Han, and Han (2005), Liu and Chen (2005), Beck, Kung, Park, and Yang (2004), and numerous others.

In particular, some of these technologies have been recognized as useful in the classroom, and have been engaged in innovative

ways. The technologies of particular interest are those that are referred to as "conversational technologies," which allow for the creation and sharing of information (KPMG, 2003; Wagner, 2004). Another term often used to describe these technologies is the concept of "constructivist learning tools," which encourage, and are focused on, users creating, or constructing, their own content (Seitzinger, 2006).

The interest in employing these kinds of technologies stems not only from the unique pedagogical benefits gained, but also from the basic need to stay in tune with the focus and strengths of today's students. Prensky (2001) suggests that the students being taught today are "no longer the people our educational system was designed to teach" and that while the students of today can be termed "digital natives," many educators could be better termed "digital immigrants." Yet another way to look at this is to view earlier educational approaches as "print-based," while those of the current environment can be called "digitally-based, secondly-oral" (Ferris & Wilder, 2006).

The purpose of this article is to examine these technologies and explore both the evolution of their use from personal applications to that of educational tools, and also to examine the key educational applications for which these are being used. Relevant research and applications are examined and analyzed. The future of these technologies for educational and professional use, together with viable research areas, is examined as well.

CONVERSATIONAL TECHNOLOGIES AND CONSTRUCTIVIST LEARNING TOOLS

The notion of conversational technologies is not a new one, as it encompasses many types of systems that have been widely used for some time, including e-mail, video conferencing, and discussion forums.

The term "conversational technology" is derived from the work of Locke et al. (2000) relating to conversational exchanges and his Cluetrain Manifesto. One of the key concepts here is that "markets are conversations" and that knowledge is created and shared using question and answer dialog. Specific theses that relate to this form of "conversational knowledge management" suggest that aggregation and abstraction of information helps to create information. Other characteristics of conversational knowledge management include the fact that it is fast, stored in different locations, and does not require sophisticated technologies in order to be accomplished (Wagner, 2004).

Conversational technologies encompass a wide range of systems and software, many of which are familiar, including e-mail, instant messaging, Web pages, discussion forums, video and audio content/streaming, wikis, and Weblogs. While there are specific aspects that are of interest in terms of the more mature technologies, the ones that will be given attention in this article are the issues, impacts, and applications relating to IM, blogs, wikis, and podcasts. These are technologies that are newer, have a growing base of users, and are starting to become recognized as viable tools for education.

The term "constructivist learning tool" has also become associated with these, particularly blogs and wikis, in that they have a key characteristic of allowing users to develop and maintain their own content. Some of the characteristics of constructivist learning include engagement, active learning, collaboration, real world based, and the usage of reflection as a part of the learning process (Seitzinger, 2006).

It should be noted that these technologies and tools are best suited to course structures where class collaboration and communication are encouraged, rather than those with an emphasis on lectures and a presentation of factual information. In addition, in courses where there is substantial group work, or projects where a collaborative document is created, the use of these would be especially helpful and useful. Both hybrid and full distance learning courses would be situations where these could also be used effectively.

TEACHING AND LEARNING: NEW TRENDS

Conversational and constructivist technologies are certainly here to stay, as evidenced by their extensive role in our society. It would therefore be useful to examine their applicability in the educational realm. While usage based on popularity or student preference seems to be one factor, there are also theoretical and conceptual bases for employing these kinds of technologies in the classroom.

Earlier paradigms of teaching emphasized print-based materials for instruction, which included printed textbooks, paper-based instructional materials, and written tutorials, all of which are grounded in the notion that the teacher, lecture, and instructional materials form not only the basis, but also the authority in the educational process. The transmission of material from the teacher (lecture) and/or textbook to the student (called the "print model") is still the central basis of most teaching, even if they are supplemented with other methods including discussion and other forms of student interaction/participation (Ferris & Wilder, 2006).

However, the advent of digital and conversational technologies has brought forth the new concept of secondary orality (Ong, 1982). This concept emphasizes that teaching and learning should go beyond printed materials toward a greater emphasis on group work, fostering student communities, and encouraging student participation. The concept encourages a greater sense of interaction with and "ownership" of knowledge, emphasizing self-awareness and expression, and effectively using electronic tools (Gronbeck, Farrell, & Soukup, 1991).

The use of conversational technologies can have a positive impact, because they attempt to not only improve upon the print approach, but also use secondary-oral techniques. In other words, while a student can still be presented with material (in different formats) using the print model, the introduction of secondary-oral methods can be used to improve the overall learning experience. Using the latter, there is the opportunity to work and learn collaboratively, explore, analyze, engage in discussion, and otherwise "learn" in new and innovative ways (Ferris & Wilder, 2006; Wallace, 2005).

INSTANT MESSAGING (IM)

It is unlikely that there would be many college students who are unfamiliar with the use of IM. Allowing for interactive and real-time synchronous communications with instant response, instant messenger is truly conversational in that it allows for "chat" and communications between both individuals and groups. The major instant messaging systems in use include AOL (AIM), MSN Messenger, Yahoo! Messenger, and ICQ.

IM is a means for users to "chat" and communicate in real-time. While originally the domain of personal users, over time the unique benefits and effectiveness of this medium were realized, and IM started to become accepted as a form of communication in businesses (particularly high-tech firms), and now has been studied and tested as an educational tool (Kinzie, Whitaker, & Hofer, 2005).

The important features of IM include both its synchronous nature and its ability to support both chat and phone-like interaction. While real-time interaction allows for rapid communications to occur, there is also no need to enter an interaction "space" as with chat rooms. Instead, the main usage of IM is in one-on-one communications, which can be more formally termed as a dyadic "call" model, which more closely resembles phone call interaction. It should be noted that even though much of the communication is done between two individuals, there are some systems that support multiparty instant messaging.

Some of the salient features of IM include the ability for users to see user details as to current status (online, idle, away, out to lunch), and also on a user's changes in status (active, logged out, etc.). Lists of users can be displayed on the screen, so that contact can be made when desired. If a "chat" is initiated, a special window comes up, and the interaction can commence, provided that both parties are online and willing to proceed.

The real-time nature of IM has resulted in the technology being used for reasons aside from personal "chat." In business, IM has become in some industries an accepted form of communication. A number of studies have concluded that instant messaging is ideal for informal interaction. In particular, the use of IM has been shown to be helpful in cases where collaborative coordination and problem solving is involved. Social bonding and interaction, which is a component contributing to the success of more complex collaboration situations, is also enhanced by using instant messenger technology (Nardi & Bradner, 2000).

An important difference between IM and e-mail is the tendency for instant messenger interaction to be more casual and informal than e-mails, which helps to bring about a more "friendly" communication atmosphere. This may in part be due to a reduction in the formalities that are typically involved when using e-mail or the phone. In particular, IM has been considered more suitable for such tasks as scheduling meetings, asking or answering quick questions, and for other kinds of tasks that are brief, require a prompt response, or are less formal. It is perceived to be far simpler to IM someone to ask a quick question, for example, or to confirm a meeting or lunch, rather than to e-mail or call (Nardi & Bradner, 2000).

It is also of interest that IM communications tend to be more flexible in terms of their uses (everything from task-related questions to a new joke), and can allow for greater expressiveness in terms of emotion, humor, and personality (Nardi & Bradner, 2000). Another interesting aspect is what Nardi and Bradner (2000) refer to as "outeraction," which focuses on the processes associated with IM. These include conversational availability, communications zones, intermittent conversations, awareness, and conversational progress/media switching. IM is useful in certain communications situations, since it tends to be less disruptive and interrupting, while at the same time a user's availability is more clearly known (scanning buddy list status, for example). It is also a convenient means for setting up more formal interactions, such as arranging a conference call (media switching). Intermittent, dispersed communications can be conducted over a longer period of time, which includes interruptions. Another benefit includes the knowledge that others are "there" and available, even if not currently in chat mode; however there is always the opportunity to make contact, whether through IM or a different form of communications.

While some educators may scoff at and even express criticism at the thought of instant messaging as a viable educational tool, others believe there is potential in the medium.

In terms of educational uses for IM, they are being explored and tested. Clearly, IM not only allows students to collaborate more effectively on homework assignments and projects, but also helps to maintain a closer social network between students, which could have a positive impact on learning. In addition, if IM is carefully targeted and focused toward the material or lecture topic in hand, the use of IM may actually help and stimulate deeper and more active learning.

On the other hand, it has been hypothesized that the distraction of working on various other tasks in parallel with IM, known as "distracted attention," may have a negative impact on learning (Hembrooke & Gay, 2003).

Active learning (Grabinger, 1996) and dual (verbal and visual) processing (Clark & Paivio, 1991) are at work here. It could be said that using IM to encourage greater discussion and reflection on the course contents would be likened to the use of discussion boards; however, since IM is a real-time technology, the interaction is conducted during the lecture or class, not afterward. Some studies have reported positive effects and student satisfaction from IM being used to discuss course subjects in real-time (Guernsey, 2003).

A study by Kinzie et al. (2005) examined the use of IM during classroom lectures and found that while the general idea of using IM online discussions was positively received, the actual process and experience of using IM to conduct discussions during class lecture sessions was not found to be less than a positive experience

by both teachers and students. It was suggested that the difficulties of multitasking and dividing one's attention between the lecture and instructor, doing the IM discussion, contributed to the lack of satisfaction with the process.

Burke (2004) used instant messaging as a medium for creating course diaries in three different mathematics courses. IM was chosen since it was thought to be popular, widely used by students, and considered more "fun," so there was some hope that this popularity would transfer over to greater and more enthusiastic usage by students. In fact, the choice was made to use IM over a seemingly more suitable choice, blogs. A bot was created that would retrieve IM diary entries from students and store them in a PostgreSQL database, and there was also a program set up to display diary entries from each student, viewable by both the student and the instructor. The main finding of the study was that the IM media was not ideally suited for all kinds of courses, especially those that involved creating longer portions of text, or involved diagramming. Error detection and recovery was also not that well developed, and also there was a need for better editing tools.

In summary, while instant messenger can be appropriate for various applications, in

Table 1.

INSTANT MESSAGING	
Description	Real-time communications that allow for informal communications to be conducted easily and quickly
Advantages	Availability and acceptance by students Social presence (know the status of other users online) Real-time (synchronous) communications Encourages collaboration Reduces formality in communications
Disadvantages	Distracted attention, especially in a classroom setting "Time waster" that is not directed toward course content, but on personal discussions Expectations of 24-7 instructor access Can be time consuming for instructors Benefits are uncertain in classroom settings
Educational applications	Virtual office hours (instructor-student) Collaboration on group projects Real-time class discussions Mentoring
Course/subject suitability	Courses with group projects and assignments Distance learning support
Theoretical foundations	Active learning Dual (verbal and visual) processing

particular for information communications in a business setting, the results from educational studies appear to be mixed, with both positive and negative effects noted. While there seem to be advantages to real-time communications between students, between students and instructors, and also between groups working on a project, it appears that there are problems and limitations if the technology is used in a classroom setting. The challenges of focusing on a class lecture, together with maintaining a conversation online, seem to be a problem that has not yet been resolved. In addition, while instructors can often establish closer relationships with students using IM, there is also the problem of unreasonable student expectations of continuous teacher access, which may not be present if IM was not available as an option. In connection with this, using IM for student help can result in a greater time commitment, since sessions can become lengthy with many questions and responses being sent back and forth.

BLOGS (WEBLOGS)

Blogs started as a means for expressive individuals to post online diaries of themselves. Complete with text and photos, these logs were essentially an individual's online narrative or diary, with events, stories, and opinions. While its original use was for personal expression, recently its effectiveness as a tool for education has been discovered, including its use as an extension of "learning logs," which are created online (Barger, 1997). One of the earliest blogs, as we know and use them today, was Dave Winer's Scripting News, which was put online in 1997. While the use of Weblogs can be considered generally new, the concepts of keeping a "log" or "learning log" is not.

The concept of "learning logs" has been in use since before the advent of the Weblog. The concept of this is to enable someone to document his or her learning, and also to do some critical reflection (Fulwiler, 1987) and self-analysis. The use of a learning log or journal is related to action research learning strategies (Cherry, 1998) and attempts to link previous knowledge and new information learned. Blogs are a natural extension of learning logs/journals in that they are electronic and can be made available ("published") more easily (Armstrong, Berry, & Lamshed, 2004).

The use of electronic Weblogs as educational tools offers the benefits of increased information sharing, simplified publication of information, and improved instructor monitoring and review (Flatley, 2005; Wagner, 2003). The use of blogs has been expanding, as Perseus Development reported that there were some 10 million blogs in 2004, and the number is ever increasing (Nussbaum, 2004). The growth in this area is expected to increase in the years to come.

Blogs can be defined more formally as being "frequently updated Web sites consisting of dated entries arranged in reverse chronological order" (Walker, 2005) and can take several forms, including the personal diary/journal, knowledge-based logs, and filter blogs. The first, an electronic, online diary of one's life events and opinions, is probably the most common. The online diary/journal blog is one that, being on the Internet, is public, as opposed to the traditional (typically paper) diaries, which are generally kept private. It should come as no surprise that there are many different online diary/journal blogs that are currently online, where one can find out details, often much more than one might want to know, about someone's life and thoughts. Personal blogs form the majority of the blogs that are currently online and available, which make up roughly 70% of all the blogs in existence (Herring et al., 2003).

The second type (knowledge-based) captures knowledge and places it online in various formats. The third type (filter) attempts to select, rate, or comment on information contained in other sites (Herring et al., 2004).

There are software packages that are designed to help users create blogs, including Blogger, Xanga, Blurty, and MovableType. While the basic features of most blog software emphasize the creation of blog pages, some of the more sophisticated ones offer the capability to track readership, see who followed what links, add photos, and set up more advanced

structures. When online, blogs can range from being totally public (listed in the blog service directory), to being "unlisted" but still open to being highly restricted (password-protected).

Blogs are also interesting and unique in that they are not merely online versions of paper diaries and journals. Rather, as a communications medium under the control of the main writer (author), it is reflective of the fact that an audience is "watching and listening." What is put on a blog is not merely a one-sided set of thoughts and reporting of events; there can also be responses to feedback and reactions from the "viewing audience." Therefore, blogging is considered a highly social activity, rather than a personal one. In fact, recent work has indicated that the momentum for creating, and also updating a blog, came about as a result of encouragement from friends and the viewing audience (Nardi et al., 2004). In addition, blogging can have negative repercussions when posted information is perceived to be confidential, proprietary, or improper. In some cases, employees posting what was considered by their employers as "confidential" information can cause problems.

Blogs do not, in general, exhibit a free-flow of information between the blogger and the outside audience. While feedback is often requested, received, and desired by the blogger, the level and quantity of feedback from readers is generally limited compared with the output from the blog writer. In addition, while blogs may have sections where hyperlinks are mentioned, the number of hyperlinks in blog pages is frequently not very large (Schiano, Nardi, Gumbrecht, & Swartz, 2004).

More formally, Weblogs can be considered to be objects motivating human behavior, which is related to activity theory. Activity theory states that there are objects that have motives that respond to a human need or desire, and that they manifest a person's desire to accomplish that motive (Leontiev, 1978; Vygotsky, 1986). The objects that connect bloggers to their own social networks include letting people know what is happening in their lives, voicing opinions, asking for feedback, and "letting off steam" about certain challenges or difficulties currently being experienced, to name a few (Nardi et al., 2004).

Blogs have been categorized by Krisnamurthy (2002) as being categorized into four different types, along the dimensions of individual versus community, and personal versus topical. A blog can therefore range from being very individual and personal, all the way to being open to the community, however very focused on a particular topic.

The acceptance of blogs for educational purposes is gaining interest, with one university, the University of Maryland, attempting to implement blogging software campus-wide (Higgins, Reeves, & Byrd, 2004).

In addition, the educational uses of blogs take advantage of their ability to encourage expression and the development of online relationships. Blogs allow for learning and interaction to be more knowledge-centered, especially if the assignments are structured in the format of encouraging feedback and input from the instructor and outside experts. Blogs also allow students to gain a better understanding of a subject's knowledge domain (Glogoff, 2005). As an example of this type of blog-enhanced class structure, students might be provided with a Weblog from which to complete certain course assignments. After researching the indicated subject, the student would present the new information by "publishing" it to the Weblog. The Weblog would constitute the student's assignment, which would then be subject to review and critique by not only the instructor, but also by other students in the class. Supplementing this could be discussion boards, where threads would be devoted to discussions on the Weblogs created by the students. This kind of assignment and interaction would be especially useful for both hybrid and fully online distance learning courses (Glogoff, 2005).

There are other benefits of Weblogs. These could be expressed using the learning theories and concepts of guided discovery, directive learning, receptive learning, and social/community-centered instruction.

Guided discovery allows for the exploration and study of a certain topic, which is then followed by assignments that emphasize the synthesis of information. In effect, a student can be asked to research an area and "construct knowledge" using the Weblog as a medium. Part of the assignment goes beyond merely explaining or presenting the material, and asks for the application of the concept using a real-world situation. The ability for students to post and make comments about other students' blogs provides an atmosphere of interactivity and collaboration. One of the advantages of using blogs together with guided discovery is that it encourages the use of cognitive scaffolding, where students would approach learning (together with the use of blogs and interaction) by repeatedly seeking information, reflecting and thinking about what has been learned, and then going back and obtaining more information, so as to build upon and dig deeper into the subject area. This can result in a more active and productive form of learning (Betts & Glogoff, 2004; Glogoff, 2005).

Directive learning, where responses from students are followed by prompt feedback from instructors, can also be supported using blogs. In this case, students would not only use a blog to submit assignments, but also to review instructor feedback. In additional to feedback, there would be opportunities for the instructor to ask additional questions, in effect, to encourage further exploration and "drilling down" into the subject (Betts & Glogoff, 2004; Glogoff, 2005).

Receptive learning is where instructional modules are presented that focus on certain broader areas, from which certain sub-areas within these are highlighted for a student to research and report on. Generally, the areas are contained within a designated theoretical context (Betts & Glogoff, 2004; Glogoff, 2005).

Social/community-centered instruction is a logical component of educational work using blogs, and in particular the use of peer and social interaction as a part of the learning process. The use of blogs functions as an easily accessible medium for students to present their findings (and to be read by others) and also to integrate not only the information presented, but also related links and references to other resources. This form of interaction helps to encourage further exploration by students. A blog-based discussion can then be continued by conducting peer reviews of other students' blogs, which may include commentary, critique, the posing of questions, and opening up the way for further inquiry. The ability to share and benefit from the findings of other students (and to explore further) is another important outcome. The theories of community practice (Snyder, 2002), social cognition (Vygotsky, 1978), and communities of inquiry (Lipman, 1991) provide support for the blog-related techniques mentioned previously.

Ducate and Lomicka (2005) discuss their experiences in using Weblogs to support foreign language classes. Weblogs help the foreign language student to learn during the process of reading, and then creating blog entries. Students can learn by reading blogs that are written in the new, target language, including learning new vocabulary, checking out links and further information on words, and learning associated cultural information. The reading and absorption of blogs on the culture associated with the target language, including literature and lifestyles, all would contribute to the learning process.

Another approach would be to have students maintain blogs written in their new, target language, and then the goal would be to seek commentary and critique on these blogs by others in the class. Yet another innovative method might be to share blogs with other classes studying the same language, and for students to read and comment on each other's postings. In the case where students travel to a country where the target language is spoken, the compilation of travel blogs would be a useful learning tool as well (Ducate & Lomicka, 2005).

Wang and Fang (2005) looked at whether the use of blogs encouraged or enhanced cooperative learning in an English rhetoric/writing class taught in Taiwan. The main premise was that blogs can encourage students to spend more time working within a class "community" and

can benefit from a greater sharing of contributions and inputs. In general, cooperative learning benefits can be divided into three different types: formal, informal, and base groups. Formal cooperative learning is where the instructor explicitly provides course materials and assignments to a group and then observes the students' learning processes. When the instructor provides information more generally (such as detailing how to use a blog for course assignments) and then lets the group work out their own methods for handling an assignment, that is known as informal cooperative learning. When a learning-oriented group is maintained for an extended period of time, such as throughout a semester, then this form of cooperative learning is known as a cooperative base group (Johnson & Johnson, 1998; Johnson, Johnson, & Holubec, 1991). The study, run over the course of a semester, found that the use of blogs contributed not only to cooperative learning in general, but also to autonomous learning. Autonomous learning is focused on how much students take responsibility for their own learning, and also develop self-confidence in the task or skill (Wenden, 1991). The use of blog technologies was also

Table 2.

WEBLOGS (BLOGS)	
Description	A technology that allows a sequence of entries (online diary, journal) to be posted and published online
Advantages	Reflection and critical thinking are encouraged Authenticity through publication Social presence Development of a learning community Active learning encouraged Ability to receive and respond to feedback
Disadvantages	Controlled primarily by blog author Editing/modifications not open as in a wiki
Educational applications	Online learning journal Problem solving/manipulation space Online gallery space (writings, portfolio, other work) Peer review exercises
Course/ subject suitability	Writing courses Foreign language courses Research seminars
Theoretical foundations	Activity theory Guided discovery Cognitive scaffolding Receptive learning Social cognition Community practice Communities of inquiry

found to help improve information processing, learning self-evaluation, and effective time management (Wang & Fang, 2005).

Martindale and Wiley (2005) also used blogs in their courses and looked at two cases of the impact of this technology on teaching and learning. Martindale taught a doctoral-level course on instructional design and technology. In it, students were introduced to blogs and used them throughout the course, which overall tended to promote higher levels of quality in their course work. Blogs were used to post ideas and abstracts of their projects, and also to place links for relevant research papers and Web-based resources. The end result was a course "knowledge base" that represented the cumulative output of the students in the course. The blogs were also used for article critiques, which were an integral part of each weekly class. Students were given access to the blogs of other students and were able to offer feedback.

Wiley taught two different courses, one on online learning research, and the other on online interaction culture. Both included the use of blogs as a supporting technology, the first employing a general course blog where information about the course, student assignments, and class updates and student/instructor interaction exchanges were posted on an ongoing basis. In the second, blogs were used to discuss experiences using different online communications technologies, causing students to become highly engaged, resulting in passionate discussions and detailed commentaries posted to the blogs, far exceeding the level and depth of feedback that was expected (Martindale & Wiley, 2005).

In summary, blogs can be useful for educational purposes, particularly where there is the need to encourage and stimulate critical thinking and reflection on a work, concept, or idea. The submission or publication of a document or text as a blog can then lead others in a class to review and comment, setting the stage for greater analysis and study. In particular, blogs are suited to writing courses, where a text can be analyzed and critiqued, or for a situation where a peer review is desired. The use of blogs is also ideal for the situation where someone keeps an online journal of one's learning, or wants to display her or her work to an audience. The blog approach is also considered useful for group study of a certain focused problem or case, such as those used in graduate courses and seminars.

WIKIS

Yet another technology, known as the wiki, has emerged, which allows for improved collaboration compared with Weblogs. While the major emphasis of Weblogs is the creation of a set of pages and documents primarily by a single individual, the strength of a wiki is the ability for numerous interested readers and users to express ideas online, edit someone else's work, send and receive ideas, and post links to related resources and sites. As a result, wikis go a step further and allow for greater collaboration and interactivity (Chawner & Gorman, 2002). Wikis have been found to have value for educational purposes, and their use has begun to be integrated into a number of university courses, in particular (Kinzie, 2005).

The term "wiki" comes from the Hawaiian word "wikiwiki," which means "fast." The technology is computer-based and can be generally described as a knowledge sharing and creation system that has as its basis a set of Web pages, which can be created and updated on an iterative and collaborative basis, and is in many ways a form of groupware. A wiki is designed to run on the Internet and World Wide Web, uses the HTTP protocol, and resembles traditional Web sites in terms of its underlying structure. Some of the benefits of wikis include the ability to easily create pages (using a simplified form of HTML or basic HTML) and the ability for a document to be authored collaboratively and collectively. In particular, simplicity is the key to wikis, and wiki pages have been designed to be easy to create, (simpler than the process of creating standard Web pages). One of the better-known examples of a wiki is www.wikipedia.org, which is an online encyclopedia with entries authored and edited by different persons worldwide, and in several different languages as well. In essence, it is an

online information resource that is authored by interested and knowledgeable persons from around the world.

Wagner (2004) developed a set of design principles that relate to wikis. These are the principles of open, incremental, organic, mundane, universal, overt, unified, precise, tolerant, observable, and convergent wikis. *Open* means that anyone can edit a wiki, creating an "open source" environment for the sharing of knowledge. *Incremental* means that new pages can be added, even if they do not yet exist. *Organic* means that the information can be continuously evolving, as changes and edits are made. Wikis are *mundane* because they involve the use of a simplified set of essential commands. The design of wikis is also *universal*, meaning that writing and editing is a "combined" activity, formatting is related to input (*overt*), page names are not context specific (*unified*), and pages are generally named with some precision *(precise*). Wikis should be *tolerant* of error; activity should be *observable* by all, and duplications are undesirable and should be deleted (*convergent*).

There are a number of software programs that enable the effective creation of wiki pages, including TikiWiki, TWiki, and Pmwiki. These allow for the effective creation, modification/editing, and management of wikis, including creating pages, creating links, formatting, and feature modules (discussion forums, photo pages, download areas, etc.) (Chawner & Lewis, 2006)

Wikis are set up to allow for easy collaboration, and more specifically, editing. Rather than passively reading a passage of text or related information (which may include graphics, multimedia, hyperlinks, etc.), a reader of a wiki can also take on the role of a writer, making changes to the text (re-organizing, editing, rewriting, and marking up) at will. In essence, the document is open to changes by a "collaborative community," which allows for the secondary-oral model in education to be applied.

One reservation on the part of educators to embrace wikis is the fact that wikis are designed to allow for open and free access and editing by all members of a "community." As a result, if improperly managed, a wiki's content can become an unreliable, inaccurate, or biased source of information due to its largely unmonitored format. There is also the issue of having little or no "quality control," resulting in a wiki not being trusted by its readers and users. An example of this was the controversy over the accuracy and reliability of Wikipedia, in the case of John Seigenthaler, in which the subject alleged that false and incorrect statements were posted in his biography (Seigenthaler, 2005). However, other studies have attempted to prove that Wikipedia was overall an accurate information source. One article reported that after analyzing a set of Wikipedia's science articles, they were judged to be, by the British journal Nature, as reliable as the Encyclopedia Britannica (BBC News, 2005).

Wikis are useful for education in that they help to promote student participation and also a sense of group community and purpose in learning. Indeed, an important element of this is the relaxed sense of control over the content, allowing students to have a greater role in managing its focus and direction.

Wikis are not all the same, and there is significant diversity between various forms and implementations of wiki systems. In fact, it could be debated what features truly characterize a "true" wiki. The features inherent in most include the ability for users to both read and edit information, without the need for security or access restrictions. The emphasis is on simplicity, and the informal, "never finished" nature of wikis, which may constitute the contributions of multiple authors, is another key characteristic. While the emphasis of many wikis is on simplicity and a lack of access restrictions, that does not mean that all wikis work this way. In reality, there can be a continuum of features from simple to complex. At the complex end of the scale can be capabilities for security/access restrictions, complex organizational structures, and for integrated with content management systems (Lamb, 2004).

Now that the strengths and weaknesses of wikis have been established, it would be useful to examine the educational applications of

wikis. In general, the most suitable applications are those that take advantage of the wiki's free, open structure. As such, the use of wikis as discussion/bulletin boards, brainstorming tools, and online sketchpads is appropriate. Meeting planning is another viable application area, in that the organizer can start with a preliminary agenda, from which the other participants can then add their own additions or make modifications or comments.

An important application area for wikis has been identified in knowledge management (KM). The use of wikis for knowledge management may allow for an improvement over existing systems and technologies. Currently, with existing KM systems, there does exist a number of bottlenecks relating to knowledge acquisition, namely acquisition latency, narrow bandwidths, knowledge inaccuracy, and "maintenance traps." Basically, these knowledge acquisition bottlenecks result from a time lag between when the knowledge is created, and then distributed. In addition, there are the problems of limited channels of knowledge input, possibilities of erroneous information being received, and also the difficulties of maintaining the knowledge base as it grows larger (Land, 2002; Wagner, 2006; Waterman, 1986).

The use of wikis to elicit a "bazaar" approach to knowledge management, rather than a "cathedral" approach, is proposed as a better alternative. These terms are derived from software development, whether the "bazaar" allows for more continuous and open access to code (or information), as opposed to the "cathedral" approach where access is only provided on certain (release) dates to certain persons. The difference between the "cathedral" (closed), sources of knowledge acquisition management and "bazaar" (open) could be illustrated by the difference between encyclopedias that are created by a single firm, such as Encarta or the Encyclopedia Brittanica, and those that obtain information from readers and users, such as the well-known Wikipedia.

The emphasis therefore is on teamwork, continuous review and testing, and the development of conversational sharing (Wagner, 2006). Inherent in the workings of wikis is support for an open, collaborative environment, where many people can contribute to the development of knowledge instead of being limited to a set of "experts." It appears that conversational knowledge acquisition and management are appropriate for wikis (Cheung, Lee, Ip, & Wagner, 2005). As for educational applications and KM, a study by Raman, Ryan, and Olfman (2005) examined the use of a wiki to help encourage and support collaborative activities in a knowledge management course. More specifically, using wikis in the course helped to encourage openness and better sharing and updating of knowledge bases. Many-to-many communication is supported, and the persistence of the created pages formed the basis of a knowledge repository. In short, the impact of easy page creation and improved updating and editing, together with effective maintenance of knowledge histories, were seen as positives (Raman et al., 2005; Bergin, 2002).

Activities in the KM course activities included group article review assignments, answering questions about sharing knowledge and uses of the wiki technology, and also creating a wiki-based knowledge management system. Students were asked to create, update, refine, and then maintain a class knowledge management system. In terms of these experiences, while the use of the wiki technology was generally viewed positively, feedback received indicated that, since the goals of using the wiki were not made clear, using one was perceived to be counter-productive. More specific guidance on goals and objectives, a clearer system structure, and advanced training were suggested as ways to make the wiki a more effective educational tool. The availability of too many features made the task of doing the course activities more difficult, since much time was spent learning the various features rather than focusing on the task at hand. A simpler, less feature-rich version was therefore preferred (Raman et al., 2005).

Another popular application of wikis in the classroom is in supporting writing courses. The use of this technology can help to foster the impression that writing is "fun," and that

there can be a shared and collaborative side to writing, revising, and commenting on written work. In other words, the technology can benefit not only the writing and editing process, but also in bringing about an awareness that writing is being done for a specific audience.

An example of the use of wikis in English is the Romantic Audience Program at Bowdoin College, where students used a wiki to discuss and examine Romantic literature, focusing on poetry, poets, and related topics. The technology was used to elicit discussion and analyses by the group, encourage elaboration on areas where further study or insight was sought, and to seek out linkages to additional sources and commentary. Another project is Auburn University's Wikifish, which was created by one school within the university, where questions are posed, and opinions and comments by all are encouraged.

Difficulties encountered in using wikis for education include the difficulty of tracking the new pages and contributions made by students, since modification can be made to another student's text without specifically identifying the author or editor. As a result, it can be difficult to monitor, and properly attribute, what contributions were made by whom, on a particular page. A proposed solution to this was an instructor's use of categories and topics, requiring that students link to and add, rather than simply modify, the contributions of other students. Another issue was how much of a balance in terms of the tradeoff between total freedom, and total control, was ideal. Since a clear benefit of a wiki is the emphasis on free expression and on spontaneous inputs, reducing this may have a negative effect on open interaction and student contributions (Lamb, 2004).

An interesting application of the use of wikis in the classroom was the work by Bruns and Humphreys (2005), where wikis were used in a New Media Technologies course to collaboratively develop entries for an online wiki encyclopedia called the M*/Cyclopedia of New Media*, an actual live wiki resource made

Table 3.

WIKI	
Description	A technology that allows for material to be easily published online, and also allows open editing and inputs by a group
Advantages	Contributions and editing by a group Open access to all users Collaborative
Disadvantages	Lack of organization and structure may result in an unmanageable wiki Tracking of contributions and modifications can be difficult Quality control
Educational applications	Collaborative writing/authoring Group project management Brainstorming activities Knowledge base creation (knowledge management)
Course/subject suitability	Knowledge management Writing Group work in courses
Theoretical foundations	Conversational technology Constructivist learning tool

available online. The effort to develop entries involved over 150 students spanning six classes in the program. Feedback indicated that while students had little difficulty with using the wiki system, obstacles came about more with the writing and format of the encyclopedia entries.

Another study examined the use of wiki technology in German-speaking communities in Switzerland (Honegger, 2005), while Desilets, Paquet, and Vinson (2005) looked at how usable wikis are and found that the main problems encountered related to the management of hyperlinks. Wikis were also examined from the perspective of structure: how did the use of certain templates affect the appearance and layout of wiki pages? The results suggested that they are useful in certain circumstances and could be helpful overall to end users (Haake, Lukosch, & Schummer, 2005).

In summary, wikis are best suited to course and activities where there is a document, text, or other project to be worked on jointly by a class or group. In a sense, it is a tool for collaboration, and a form of groupware. The compilation of a class or group report or project, the creation of a knowledge base, or brainstorming sessions appear to be viable applications. The free and open structure, however, can fall prey to disorganization and degradation in quality, and so it is important to have safeguards and procedures in place to ensure an effective result.

PODCASTS

While the terms "pod" and "podcast" at first mention might evoke visions of "Invasion of the Body Snatchers," for most tech people in the know, the reference to Pod is almost certainly a reference to Apple's popular and ubiquitous iPod.

However, podcasts are in actuality not what their name might imply them to be. A "podcast," a combination of "iPod" and "broadcast," neither refers to a technology specifically requiring an iPod, nor broadcasts information to users. Instead, podcasts are multimedia files (typically audio or video) that are downloaded to users on a subscription basis. Because of the potential confusion due to the use of the word "pod," some have called for the letters to mean "personal option digital" or "personal on demand, " rather than iPod.

Podcasts can be played back on any device or system that can play digital audio (typically MP3) or video files, and are not broadcast to a large audience, in the way that television, radio, or spam e-mails are sent. Instead, they are sent to users who have specifically subscribed to a podcast service, and as such, files are automatically downloaded to the user's computer when they are ready and available. In addition, podcast files are generally not streamed (as video is streamed), but rather are downloaded for later playback (Lim, 2005; Lum, 2006). Podcasts are delivered to subscribers through the use of RSS or RFD XML format media feeds, rather than more traditional forms of downloading (Descy, 2005).

Podcasts are considered to be a viable educational tool for several reasons. First, because of the popularity and wide use of devices such as the iPod and similar units, it would seem like a good medium from which to distribute educational materials. Secondly, the ease with which information can be retrieved and accessed makes this a good choice for students, who are using these devices on a regular basis for music and should have few technical difficulties or learning curves (Lum, 2006).

There are multiple facets to podcasts. First, there is the consumption perspective, where someone downloads the podcast and then listens or views it. This involves subscribing to a service (or enrolling in a course), finding the relevant file, and then downloading and playing it. Alternately, someone can actually create podcasts; an instructor can produce lessons for students, or students can produce an assignment in the form of a podcast file (Lum, 2006).

Education is one area where the power of the podcast has been used in various ways. At Duke University, orientation material was distributed as podcasts, loaded onto iPod units, and given to students in its 2004 incoming freshman class. The units were provided not only for orientation purposes, but also for use in playing podcast lectures when the students

take certain courses at the university. At Mansfield University, students were sent podcasts about various student life issues, and at Arizona State University, President Michael Crow used podcasts to deliver messages to the university community (Lum, 2006).

While there appear to be sound reasons for using podcasts, there is also a theoretical basis behind the use of podcasting. This is based on cultural-historical activity theory (Engestrom, 2002) and is based on the fact that podcasting can be considered a tool that can be used to help learners to better interact with or understand a task and its environment. Vygotsky (1978) argues that the effectiveness of podcasts rests in its linkage between social/cultural influences present in the environment and the cognitive development of the learner. Expressed another way, the concept is that since so many student have access to iPods and MP3 players, it would make sense to explore the viability of using such a device for learning and educational purposes.

Lim (2005) discussed experiences in using podcasts for teaching geography. Because of the nature of the subject, it was found that video would have a greater impact and result than audio. Students were asked to submit assignments to be created and submitted as podcasts. Overall, this helped to bring about satisfaction and interest in terms of the subject. Ractham and Zhang (2006) looked at the potential for podcasts in a classroom setting. While there are the obvious benefits in terms of being able to distributing class materials, there also are benefits in terms of contributing to social networking in the class and continuing a flow of academic knowledge. Class discussions, announcements of research activities and conferences, and also campus activities could be distributed as podcasts. Review materials could be distributed effectively on an automatic basis to interested students. In addition, the ability for students to create podcasts to be distributed to others would also be a new means of submitting assignments or expressing creativity.

Table 4.

PODCASTS	
Description	The ability to create audio (and other media) based files to be distributed on a regular/subscription basis to users; these can be easily retrieved and played back on handheld devices, computers, and through other means
Advantages	Allows for information to be retrieved and played back on widely available, ubiquitous devices More suitable to auditory and visual learners
Disadvantages	In consumption (playback) mode, does not directly support collaboration Is not inherently interactive in nature
Educational applications	Recorded class lectures Case-based instruction Guest lectures in the form of podcasts Supplemental course materials Support for distance learning courses
Course/subject suitability	Subject matter lends itself to auditory format
Theoretical Foundations	Cultural-historical activity theory

Podcasts, unlike IM, blogs, and wikis, offer a greater emphasis on providing engaging auditory and visual course materials to students, rather than on collaboration and group work. While not generally a substitute for traditional lectures and knowledge presentation, they offer the benefits of easily accessible and "digestible" course material. Whether it is excerpts from class lectures, highlights from a guest speaker, or an oral test review, the use of podcasts provides a means by which students can obtain and easily receive course-related information. In addition, it also provides a means by which students can express and present their work, which can then be "published" and distributed in podcast format.

DISCUSSION AND CONCLUSION

The face of education, whether online, hybrid, or classroom, is constantly changing, and it is important for educators to stay abreast of the many opportunities and possibilities that are available.

In this article, several technologies, generally termed as conversational technologies due to their interactive and collaborative nature, were discussed in detail, together with their capabilities, benefits, and educational applications. Relevant research and case studies as they relate to classroom and educational applications were discussed.

In general, the tools discussed here fall into the class known as "conversational technologies" or "constructivist learning tools." As such, they emphasize student interaction, group learning, and collaboration, rather than the more traditional classroom mode. In light of this, they are more suited to educational courses or environments where the emphasis is on student communication, where students have access to technology, and where creative output and thinking is encouraged.

In the situation where a course is primarily lecture-based, or is mainly concerned with the delivery of factual or conceptual information, these tools may have limited applicability. The one application that may be helpful in this case may be for interaction to be extended outside of the classroom, through the use of instant messenger, or for supplemental materials to be distributed as podcasts.

Since each of the tools has its own characteristics and suitable applications, it would be up to the educator to select those that are most appropriate to one's course and activity.

Instant messenger, which is commonly used by students for personal use, has found its way not only into the business community, but also into the classroom, because of its strengths in terms of informal communications that are conducted real-time. There are some mixed results regarding the use of IM for use for education; benefits are claimed by some, but there are limitations as well. The use of IM would best be employed in situations where group work, student communication, and real-time discussion would be helpful. However, it should be used cautiously, since it can be distracting, and students may end up carrying on personal, rather than course-related discussions.

Both blogs and wikis have been hailed as useful tools for education, and the specific advantages and disadvantages of each are noted and discussed. Blogs tend to be more one-sided, with an author presenting his of her information, with generally limited input from the readers and public. However, the use of the technology has been used effectively to promote information sharing and to support writing courses. The use of blogs to support online learning journals, class article/peer reviews, creating online portfolios and galleries, and for solving a specific problem or case would be advantageous. It would also appear to be a good medium for graduate research seminars, where papers and studies are analyzed and critiqued.

Wikis, which allow freedom in creation and in editing and enhancement by others, are especially useful in collaborative situations where the input of an entire group is desired instead of a single person's contribution. In the classroom, wiki support for collaborative writing and group activities, where students contribute to the creation of a common result, would be useful. In general, any kind of learn-

ing activity that involves the collection and maintenance of knowledge or information may benefit from the use of wiki technology.

The use of podcasts, which may include audio or video, is growing in popularity and is being used for delivery of information to subscribers on an automatic basis. Educational podcasts, both for the delivery of audio and video-based knowledge to students, and also as a new medium for the creation and presentation of assignments, appear to have potential. While podcasts are useful as a means for publishing and distributing files of multimedia-based class materials, there also exists the potential to create new podcast content, both for educators and as a course activity.

Clearly, the use of these new conversational technologies is allowing for the enhancement and continued evolution of new and innovative forms of support for teaching and learning.

FUTURE RESEARCH AREAS

Certainly, there are many benefits to the use of conversational technologies and constructivist tools for educational use. However, more research needs to be done, not only in terms of identifying additional types of applications and uses, but also in terms of how to more effectively identify and apply new approaches to learning with the aid of these kinds of technologies.

Some of the broader research issues that can be examined include measuring both learning, and the perceived quality of education, depending on the specific technology or tool employed. Are there measurable benefits to using a certain technology in terms of the material learned, better class performance, or more subjective factors? It would also be useful to determine, particularly when using blogs and wikis, the neutrality or bias in the entries, and how much these contribute to (or detract from) the material submitted for a course assignment.

Other research areas are more technology specific. It was mentioned earlier that wikis can be a useful tool in knowledge management. The application of wikis to effective knowledge management deserves further attention, both in terms of developing or adapting the wiki structure and features to knowledge management uses, and also for identifying various kinds of user interfaces and functionality that would improve usability. The establishment of wiki-supported communities of practice is one area where the tool could possibly be useful.

Podcasting also has many areas that are ripe for further investigation. There are issues that can be explored in the areas of knowledge management, collaboration, and the adoption of podcasts. Some of the specific topics of interest include the management and sharing of knowledge using podcasts, examining whether their use actually improves learning, studying their effects on collaboration and networking, and what the factors (or features) are that would help to promote its use.

There also has been work on the psychological aspects of distance learning and online courses (Dickey, 2004), and a study of learners' reactions to using IM, blogs, and wikis, for example, would yield insights into its appropriateness for its further use in education. Does the use of these technologies contribute to the satisfaction of students, or is more classroom face-to-face still better?

The realm of these new technologies is certainly ripe with a host of opportunities for both interesting and meaningful research studies.

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