WEB-BASED COMMUNITIES IN E-LEARNING

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Abstract: E-learning is a growing online service, its convenience appealing to many users. An abundance of e-learning applications have been developed which provide many features aiding both tutors and students. However, despite the growth and development of online communities in other areas, the effective establishment of these communities within e-learning is still lacking. Communication and social interaction among students forms an important part of any learning scenario. Therefore, it should also be provided for online learners. This paper presents guidelines for the development of e-learning systems which foster the establishment of communities and encourage interaction among users. The paper describes CLEV-R, our own development which employs these techniques to realise an effective online learning community.

1 INTRODUCTION

Web based applications and services have been growing immensely over the last decade. One of the most popular of these online services is e-learning (Hiltz and Turoff, 2005). Its use by universities and other teaching institutions has increased greatly since its introduction and it is now well established and a universally accepted medium for learning. The Internet is ideal for dispersing learning content as it is widely available, provides quick access to information and is cheap and convenient to use.

Continuing developments in technology over the last few years have seen the increasing availability of broadband and vast improvements in networking performance. These improvements have facilitated the provision of sophisticated and complex online services such as e-commerce, online banking, e-government etc. E-learning has also benefited and the available websites are no longer simply repositories of course materials which students access. Nowadays entire systems are being developed to help manage learning content and to support both course instructors and students. These systems are known as Learning Management Systems (LMSs) or Course Management Systems (CMSs) and examples include

BlackBoard (BlackBoard, 2006) and Moodle (Moodle, 2006). They normally provide a course tutor with ways to create and deliver content, monitor student participation, and assess student performance. They also provide interactive services for students such as discussion boards and forums.

To some extent, these systems mimic the learning scenario experienced in a real college or university. Tutors provide course notes, set assignments and tests for the students and then monitor their progress. However functionality for social interaction within these systems is often limited to discussion boards and forums, which can fail to create a true sense of community among users. Many studies have shown the importance of social awareness in any learning situation (Redfern and Naughton, 2002) (Laister and Kober, 2002). Therefore, an effective e-learning environment should support and promote a strong sense of community among users. These learning communities should aid students in their education while also bringing a social aspect to the activity.

In order to achieve this, more interactive techniques are required. We believe that newly emerged technologies such as instant communication, file sharing and multimedia, which have all proved popular for building interactive communities in other online

domains, can also be applied to great effect within the e-learning sector. They not only allow students to interact freely but also create a more motivating and stimulating environment in which to learn. Some of these issues have been addressed in other e-learning applications. In particular, the use of 3D environments for learning is a growing area of research. The use of 3D has been explored for teaching subject specific courses e.g. engineering tasks, laboratory protocol etc, (Chee and Hooi, 2002), (Nijholt, 2000), (Rickel and Johnson, 1999) while other 3D environments have been developed as interfaces to access online courses (Bouras et al., 2003), (Bouras et al., 2001). Functionality varies among these systems; many present learning content through multimedia and some support real-time communication among users. However, they often fail to create a true sense of community for their users. We have developed a system called CLEV-R which addresses this issue by providing tools which promote and encourage social interaction and awareness among users. These tools not only make the learning experience more appealing to users but also prove effective for supporting various educational activities.

The remainder of this paper is organised as follows; section 2 investigates the emergence of online communities, the technologies they use and their ever-increasing prevalence on the Internet. We then explore how to use modern technology within e-learning to develop social communities and make it more appealing to students in section 3. In section 4, we describe the e-learning system we have developed which creates an online community and promotes social interaction amongst users, while also supporting learning activities. Section 5 introduces mCLEV-R, an additional social e-learning system we have developed for use on mobile devices. The details of an evaluation study that we have conducted are discussed in section 6, while section 7 concludes with some details of our future directions.

2 ONLINE COMMUNITIES

The growth of the Internet has seen a proliferation of online communities. They allow groups of people in different geographical locations to come together and communicate their ideas, thoughts and feelings with other, often similar minded people (Wellman, 2005). Online communities are not a new phenomenon; they have been in use since the advent of the Internet. In its simplest form, an online community can consist of an email distribution list, where people share information about specific topics. Online communities are also formed through web-based discussion boards and forums where users can share expertise and give advice on certain subjects. These websites have seen the emergence of many special interest groups who communicate with each other through this computer-mediated environment. E-commerce websites are now using these techniques to encourage the formation of communities among their customers. People can leave feedback, discuss products and receive after sales service through this medium. Newer technologies have now emerged which can further enhance online communities by enabling much more interaction among users in real time. Instant communication methods and a means for users to share information easily are the key methods used.

Instant messaging is a phenomenon that has grown in popularity over the last few years and it is now integrated in many websites to create a community between its users. Chat rooms are a prime example of this. A wide variety now exist, many specialised to members' interests. While initially users communicated via text messaging, many of these communities have now progressed to using audio communication methods and web cam broadcasts. Further advancements in Internet connection speeds have permitted communities to develop using virtual reality. A 3D world is rendered, in which each member is represented by a character. One of the largest examples of such a community is Activeworlds (Activeworlds, 2006). Users become a citizen of an online 3D world and can then design and build their own areas of this 3D community. A variety of communication methods allow user to interact with each other within this 3D environment.

While this type of computer mediated communication is proving popular and continues to gain a large following, Internet users are now seeking new types of communities online. Rather than placing the emphasis on a particular topic or area of interest, websites which offer users the ability to build a social network of friends online have become popular (Williams, 2005). Bebo (Bebo, 2006) and MySpace (MySpace, 2006) are two such websites; members of the public produce a web page containing information about themselves along with photos and videos, and can also link to their friend's pages. Other users can then browse these web pages, post messages and share ideas thus building new friendships online. Friends within these social networks can also communicate instantly using various external services such as Skype (Skype, 2006) and MSN Messenger (MSN, 2006). The popularity of such services is in no doubt. Bebo has become a 'social phenomenon' and has a worldwide membership of over 22,000,000

Figure 1: A live online lecture taking place within CLEV-R.

users (Ward, 2006).

Other dedicated websites also promote sharing files online. For example, Flickr (Flickr, 2006) is a photo sharing community platform, where members of the public can upload photos for others to see (Weiss, 2005). Users can tag photos with descriptive annotations to assist with intuitive searches and can also partake in group discussions. Similar to Flickr, YouTube (YouTube, 2006) is a community for sharing videos. Members can upload videos to the YouTube website, which can then be viewed and commented on by others. As is the case with the other online communities discussed, the popularity of these file sharing websites has been growing immensely.

As the wide diffusion of the above technologies show, there has never been a greater interest in online communities. People are using the latest technologies to extend their social networks far beyond geographical boundaries. The notion is appealing to users and something many have now come to expect (Aizlewood and Doody, 2002).

3 COMMUNITY IN E-LEARNING

The growth of communities online mimics the way they form in the real world. People who attend the same places and have the same interests naturally form their own friendship networks. This is no truer than in a learning scenario. Social interaction and networks within universities is very important. Research has shown that people can learn as much from each other as they do in a structured learning session (Redfern and Naughton, 2002) (Laister and Kober, 2002). This need for social interaction and networking is something, which appears to be ill addressed in current e-learning systems. Their primary focus is on providing access to learning materials and only minimal support for communication is provided. Asynchronous communication methods such as discussion boards, bulletin boards and online forums form the backbone of person-to-person interaction within these systems. Real-time communication is lacking and this can hinder the formation of social communities, even leading to a feeling of isolation among students who are often unaware of the presence of others. We believe e-learning platforms should be more engaging and motivating, allowing users to build social networks and collaborate with each other in real-time.

Figure 2: The communications Graphical User Interface (GUI) of CLEV-R.

Thus, the following three specifications should be considered in the design of e-learning systems.

- Students should be aware of others in their class.
- They should be able to readily communicate with others, tutor and students alike.
- They should be able to collaborate on learning tasks and group assignments.

With these points in mind, we have developed an e-learning and m-learning system which places emphasis on communication and social interaction, while still effectively supporting learning activities. The remainder of this paper describes this system and in particular details the methods employed to realise an effective online learning community.

4 CLEV-R

CLEV-R is a web based collaborative learning environment which uses virtual reality to present the learning experience to users. A 3D university setting is provided where online lectures and group meetings can take place, and a Graphical User Interface (GUI) provides support for communication among members. Learning activities within the environment are supported through multimedia presentations, reviewing and downloading of course notes and an extensive communication network. Further details about the system design and a sample session are described in (McArdle et al., 2006). The 3D environment together with this communication network plays an important role in developing an online community atmosphere and is key in realising the 3 specifications outlined above.

4.1 Awareness

The use of 3D in CLEV-R not only creates a more interactive and visual learning experience, but also makes users more aware that they are present within a learning environment. It also plays an important role in making users aware of the other students taking part in the same course. As shown in figure 1, each user is represented within the environment by a 3D character known as an avatar. This character is chosen by a user on registration for a particular course and remains their representation for the duration of that course.

Users can move their avatar around the 3D University and their location is displayed in the 3D environments of all other connected users. Each avatar is unique with different hairstyles and clothing and the user's name is displayed above the avatar so they can be easily recognised by their peers. CLEV-R also provides a map of the 3D environment for each user, which can be accessed at any time and which shows the location of all other currently connected users. The Graphical User Interface (GUI) which hosts the communication controls for the system also promotes awareness of others by displaying a textual list of all other users. These features make users visibly aware of others within the system, and thus create a more natural learning environment than other e-learning platforms.

4.2 Communication

CLEV-R supports many forms of communication including text-chat, audio-chat and live web cam broadcasts. All of these methods occur in real-time and so can be used to great effect for carrying out learning activities. Users can get instant feedback on their questions and ideas but can also communicate in a natural way with each other. Text and audio communication controls are provided on the GUI as seen in figure 2. Text-chat can be used to send either public messages to all connected users or private messages to individual users within the environment.

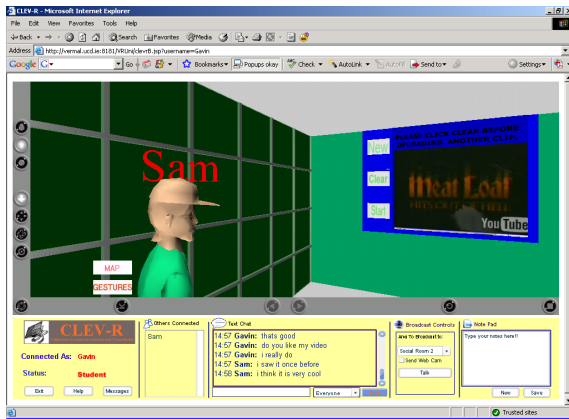Audio communication is broadcast to specific lo-

Figure 3: File sharing within CLEV-R.

cations within the 3D environment. For example, users in a group meeting room or social area can broadcast their voice and listen to others who are also present in this location. Live web cam feeds can also be displayed in certain rooms. Another form of communication within the 3D environment is the use of avatar gestures. Users can instruct their avatar to raise or lower their hand and to nod or shake their head. These actions allow users to communicate certain desires visually which others can easily understand. For example, if a student raises their hand in an online lecture it is safe to assume that they wish to ask a question.

4.3 Collaboration

Collaboration within CLEV-R is supported through sharing files and actively communicating with one another. In online lectures the tutor can upload course files to a presentation board for all others to see. However in group meeting rooms, students also have this ability. They can upload files to similar media boards to aid group discussions and project work. Thus students may upload course notes to help with a group discussion or to further understand the content, or they may upload their own files to show their work to others. Students can also use these techniques to socialise with one another. Dedicated areas of the 3D environment support informal interaction among students where they can upload personal files such as photos and even share their favourite YouTube videos with one another (see figure 3). Together with the instant communication methods described above, students can thus work, learn and socialise with each other within the CLEV-R environment.

5 MOBILE CLEV-R

Over the last few years mobile devices have become more and more popular and have emerged as an ideal tool for providing many services to users "anytime, anywhere". Research into the provision of learning services on these devices has also begun. The term m-learning has been introduced to describe learning services for mobile phones, smartphones and Personal Digital Assistants (PDAs). We too are exploring this area and have developed a system for PDAs that acts as an accompaniment to CLEV-R. This mobile version of CLEV-R is called mCLEV-R and provides users with access to course content and communication facilities while on the move. It acts as a supplement to the desktop system and can be used when students cannot be at a fixed location for their online learning. PDAs are much smaller devices that desktop PCs, with limitations in screen size, memory and processing power. Thus all of the functionality provided in the desktop system cannot be extended to this mobile platform. mCLEV-R however, still allows mobile users to actively partake in learning activities and the 3 specifications outlined in this paper are also addressed for this version of the system.

Figure 4: The 3D environment provided in mCLEV-R.

The learning experience is again presented to the user through a 3D environment. However for the mobile platform the 3D environment has been greatly simplified and it no longer supports multiple users. It is instead a single user office style environment seen

in figure 4, which users can interact with to access course materials and communication facilities. There are no avatar representations within mCLEV-R. User awareness is instead provided through the communications Graphical Users Interface (GUI).
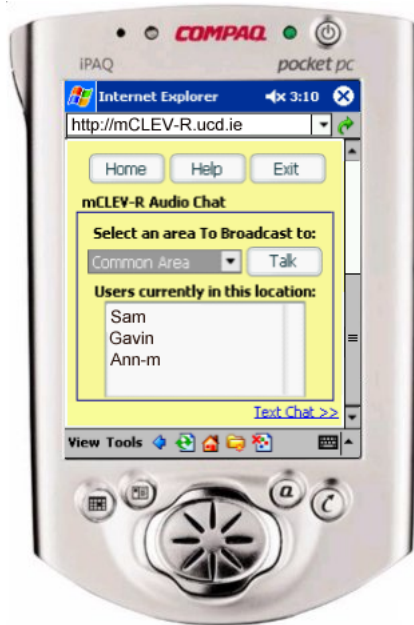

Figure 5: The audio communication Graphical User Interface (GUI) of mCLEV-R.

As in CLEV-R, both text and audio communication are supported. Through these mediums mobile users can communicate freely with all currently connected users; both those on the desktop CLEV-R system and those using the mCLEV-R system. The text chat facility can again be used to send both public and private messages. The GUI provides a list of all other connected users which can be used to select the receiver of a message. The audio communication facility allows users to broadcast their voice live into different areas of the 3D university environment provided in the desktop system. Mobile users have no access to this 3D environment, and so cannot see avatar representations of others. Thus they need some other way of knowing the location of others. When a mobile user selects a room to broadcast to from the GUI shown in figure 5, they are presented with a list of all users currently in that location. Therefore they are all the time aware of those listening to them. Similarly this mobile user is added to a list in the desktop system so that CLEV-R users are aware of their presence. These communication techniques also provide support for collaboration within the mCLEV-R system. Mobile users can actively partake in group

meetings and discussions without actually being restrained to a fixed desktop PC. They can also take part in online lectures by downloading the course notes and listening into the live commentary. Full details on how users can interact with the system for learning and communicating can be found in (Monahan et al., 2006).

Thus despite device limitations, mCLEV-R provides an effective means for users to learn and collaborate on the move and also allows them to be socially aware of others in their course.

6 EVALUATION

An initial evaluation of CLEV-R has been completed. The evaluation consisted of nine test subjects taking on the role of students within the 3D environment. The test subjects were instructed to carry out a number of distinct tasks to ensure they were exposed to the various features of CLEV-R. These included attending an online lecture, partaking in a group meeting and using the tools provided to collaborate on a group task and solve a given puzzle. Social interaction was also encouraged and participants used the features provided in the social areas to communicate and share photos with each other. Following the user trial the subjects were given a questionnaire to complete which had three strands of questioning; firstly we wished to discover any usability problems which were experienced, secondly we wanted to determine how communities operated within the environment and finally as it is an e-learning system, we wished to obtain the subjects views on the educational aspects of the environment.

6.1 Usability Results

Overall, positive results were returned from all test subjects in relation to the usability of the system and the various tools provided. 100% of users found navigation within the 3D environment intuitive and the interface easy to use. All test users actively took part in an online lecture and successfully viewed and downloaded course notes. They also uploaded their own files during a group meeting and used the communication controls effectively. While all subjects were able to use the system without any major issues arising, a small number of minor issues were revealed. These included problems using the audio communication feature and navigating through doorways within the 3D environment. These issues have since been addressed.
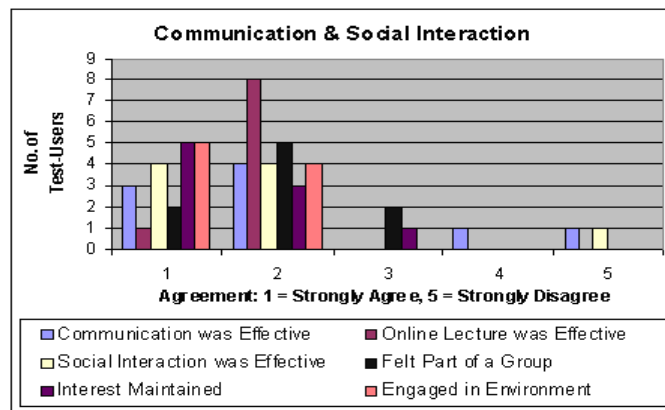
Figure 6: Feedback on communication and social awareness within CLEV-R.

6.2 Social Aspects

One key area of interest for this study was the reaction of users to the social tools provided in CLEV-R, and in particular the sense of community experienced. The feedback as shown in figure 6 was extremely positive; while using the system 78% of the test subjects felt part of a group, they were all continually aware of each other and no one felt isolated during the evaluation. Furthermore, 89% felt the environment was an effective means of social interaction. When questioned about the effectiveness of the tools for sharing files such as photos, 22% did not agree that the tools provided were an effective medium for this. It was later discovered that these test users had not uploaded their photos correctly and so others did not see them, which could account for their negativity towards this feature. Clearer instructions on how to use these tools have now been added to the system, which should prevent similar experiences in the future. Communication within CLEV-R was deemed to be effective by 78% of the test subjects. Those that returned a negative response to this question were persons who experienced echo and feedback problems during the trial, a problem that has now been rectified. One test subject specifically highlighted the real-time aspect as being particularly valuable. The results for the community and social aspects of the system show CLEV-R, along with the social tools it provides, as an effective medium for collective interaction among users.

6.3 Learning Issues

As CLEV-R is an e-learning environment, we were very interested in ascertaining peoples views on the value the system can bring to learning. Again results were positive, with all participants agreeing CLEV-R

has potential for improving online learning. The results showed that 100% of the subjects were engaged in the interactive environment and their interest in learning was maintained throughout the trial. Users of traditional e-learning platforms often cite boredom as a major drawback with such systems and so this positive result for CLEV-R is very encouraging. 100% of test subjects saw the lecture room and the facilities it provides as an effective means for online learning. The collaboration tools that the students used to work together functioned as expected and the subjects employed them effectively to solve a given puzzle. Although geared towards the educational end of the spectrum, the users saw these tools for group work as a social feature, which made learning more fun. The ability to converse with other members of the group about the task was seen as very beneficial.

Overall the system functioned as expected and the results are encouraging. Test subjects who had previous experience of e-learning systems were positive about CLEV-R and highlighted the collaborative and community aspects of the system as particular benefits. A further, more extensive user evaluation will be conducted in the near future, this time also incorporating the mCLEV-R system. The trials will focus on measuring the learnability of the systems, gauging opinions about the social community aspects as well as determining how beneficial the 3D interfaces are within the e-learning paradigm.

7 CONCLUSIONS

The growth of social networks on the Internet has never been greater. More and more services are emerging which offer users the opportunity to build social networks online. One area where the ad-

dition of social support is paramount is that of e-learning. Traditional e-learning applications are often text-based with communication limited to message boards and forums. This lack of interaction, both with learning content and others, can be unappealing to students. In this paper we have provided a set of heuristics, which we used to design and create a 3D online e-learning application called CLEV-R.

CLEV-R provides an interactive virtual reality environment in which students are immersed. The use of avatars creates a sense of awareness of others. Communication tools provide a mechanism for fostering a community spirit among students while collaborative features encourage students to work together. The tools provided for teaching, permit discussion and interaction to take place during online lectures, something that can be lacking in traditional e-learning systems.

An initial evaluation has shown that CLEV-R performed favourably and test subjects appreciated the community and social features that it provides. This initial evaluation study paves the way for a larger one, incorporating more test subjects and an increased emphasis on monitoring the use of the social tools provided. We are confident that the specifications we have outlined here and followed in the implementation of our systems, will be of great benefit within the e-learning paradigm. The community aspect will help to attract more students to e-learning, engage them and maintain their interest in their studies.

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