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## ABSTRACT

This document contains the following papers on telecommunications systems and services from the SITE (Society for Information Technology & Teacher Education) 2002 conference: (1) "Using the Web To Provide Parent Progress Reports on Standards for All Students: Developing the System" (Kevin M. Anderson and Cindy L. Anderson); (2) "Computer and Network Security" (Anu A. Gokhale); (3) "Designing, Implementing and Maintaining A Web Site: Issues and Technique Tips" (Leping Liu); (4) "PhoneChannel: Bridging the Digital Divide with Ubiquitous Technologies" (Tammy McGraw and John Ross); (5) "The Place of Internet-Based Architectures in Supporting the Professional Practice of Teaching" (Bronwyn Stuckey and others); (6) "The Transformation, Reform and Prospect of Distance Education in Taiwan" (Chih-Hsiung Tu and Hui-Ling Twu); (7) "Infusing Wireless Technology into Teacher Education" (David Zandvliet and Laura Buker); and (8) "COLEGA: A Collaborative Learning Environment Based on Individual and Group Memory Building" (Jesika Carvajal and others). A brief summary of a conference presentation on finding quality in online publications is also included. Most papers contain references. (MES)

# Telecommunications: Systems and Services (SITE 2002 Section)

Gertrude Abramson. Ed.

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**SECTION EDITOR:**

Gertrude (Trudy) Abramson, Nova Southeastern University

We are bringing the world to the classroom and the classroom to the world with the aid of computer networks, hardware and software. Educational telecommunications systems include one-way and interactive television, one-way and interactive video teleconferencing, computer-based learning, and most recently, interactive web-based learning. Almost all the papers in this section address web-based learning that has caused the explosion in distance education across all grades and around the globe. There are many papers within this annual that could have been included herein but the authors determined that their focus was not on the technology but on what was being accomplished with it. See, for example, the papers in Distance Education.

In order to achieve our collective goal of improved teaching and learning with technology, we require reliable, cost-effective, and secure telecommunications systems and services with access for all. In this new century, we are realizing the dream of computer as pencil (Papert, 1980) or ubiquitous computing (Weiser & Brown, 1997). The hot topic in hardware is wireless networks and in software, learning management systems.

**Wireless Network Systems**

Wireless telecommunications systems are beginning to establish themselves as the system of choice in higher and lower education. From the network administrator perspective, wireless networks eliminate the costs of cabling and wiring existing buildings and make it possible to add new users instantly (Charp, 2002). From the user perspective, the computer becomes as portable and ubiquitous as the cell phone and the ballpoint pen.

At the university level, major investments in campus-wide, wireless networks have been made by Cornell (<http://wnl.ece.cornell.edu/>) Carnegie Mellon (<http://www.cmu.edu/computing/wireless/>), and Tulane ([http://www.tulane.edu/~tis/new\\_site/wireless/wireless\\_home.shtml](http://www.tulane.edu/~tis/new_site/wireless/wireless_home.shtml)). At the K-12 level, wireless networks are cropping up everywhere. Proxim, a wireless technology provider, (<http://www.proxim.com/products/enterprise/solutions/k-12.html>) offers case studies of school systems that have implemented wireless systems. Some of these schools are Hayt School in Chicago, IL, Edison Elementary in Alameda, CA, Baltimore (MD) County Public Schools, Campbell Union High School District in San Jose, CA, and Camp Hill School District in Harrisburg, PA.

In January, 2002, The Maine Department of Education signed a four-year, \$37.2 million contract with Apple to supply the technology, training, and support to Maine's groundbreaking initiative that will equip all the State's 7<sup>th</sup> and 8<sup>th</sup> grade students and teachers with one-to-one access to wireless notebook computers and the Internet. The contract is believed to be the largest single purchase ever of personal educational technology ([http://www.state.me.us/mlte/newsrelease1\\_7\\_02.htm](http://www.state.me.us/mlte/newsrelease1_7_02.htm)). Closer to home, one of my doctoral students, Bruce Curry, is working with the implementation of wireless systems at St. Paul's Christian Academy in Nashville, TN (<http://www.stpaulchristianacademy.org/ne/news/newsitem.asp?id=63>).

**Learning Management Systems (LMSs)**

The need and desire to use telecommunications systems and services literally exploded. The number of schools and universities interested in getting aboard the Internet far exceeded the number of people able to create their own solutions. To accommodate the need, companies developed template programs into which teachers could upload their content and become distant educators. Some of the more popular providers are Blackboard (<http://www.blackboard.com/>), eCollege (<http://ecollege.com/>) and WebCT (<http://webct.com>). These systems are representatives of a class of software that provide learner tools and support tools. Some of the learner tools include web browsing, e-mail, bulletin boards, synchronous chat, white board and application sharing. Some of the support or teacher tools include course planning, managing and monitoring, presenting instruction and curriculum management. All providers work with higher and lower education.

## Conclusion

Because ours is a conference of teacher educators, the papers in this section relate to applications of telecommunications systems and services. Each offers a unique perspective. If you are new to this area, read them all and investigate the links provided in this introduction.

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## Using the Web to Provide Parent Progress Reports on Standards for All Students: Developing the System

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**Abstract:** Reporting for students and parents of progress on academic standards is becoming a necessity in most school districts. Kenosha Unified School District is developing a comprehensive program to provide this for parents of students in both general and special education. A pilot project to use digital video with this system is being developed with plans to integrate selected videos into teacher education as training tools for future educators. This presentation will demonstrate the Kenosha system being developed and its pilot project for pre-service teachers.

### Background

This presentation shares the progress made by the Kenosha Unified School District in southeastern Wisconsin to translate learning standards from theory into practice and to assess and report student achievement using these standards. Backed by a School Board mandate stating that “by fall 2003 all teachers will report out using standards and benchmarks”, the district has been making plans to convert from a traditional report card format using single grades per subject each marking period. Statements from some teachers, such as “Glad I’m retiring by 2003”, have made this a challenging process. Therefore, making informed, research-based decisions about daily assessment and methods of reporting student progress to parents will go a long way toward allaying the fears of teachers related to change in the traditional curricular process.

The Kenosha Unified School District began in 1995 to develop its own standards and benchmarks for academic content and lifelong learning in all grade levels PK-12. Teachers were actively involved throughout the entire process from development through Board adoption. Developed prior to the introduction of the Wisconsin State Standards, Kenosha’s standards and benchmarks are based on the standards recommendations of numerous state and national organizations. When the Wisconsin Standards were released, the Kenosha standards and benchmarks were carefully aligned to ensure coverage of essential elements on the state assessments in grades 4, 8 and 10. With the addition of the Wisconsin State High School Graduation Test (HSGT), the alignment of the standards was extended through grade 12.

Following the production of notebook-based curriculum guides, the Kenosha Schools Department of Instruction contracted with the Technology and Information Educations Services (TIES) group of Roseville, Minnesota, to develop and electronic curriculum notebook using the *Filemaker Pro* database. While the design of the electronic notebook is not completely finished, the potential of using such an electronic version of the curriculum guide is readily visible to teachers and administrators. Current plans call for producing both a web version of the notebook and a CD-ROM copy for use by teachers without web access at school or home. As they design their lessons and units using the standards and benchmarks, teachers will be able to quickly refer to activities, vocabulary words, exemplary units, web links, and suggestions for teaching about the particular skill.

Then, they will be able to “drag and drop” information from the database into a lesson plan template and create their own customized plans. In addition, the electronic notebook is intended to provide video and audio clips of actual teaching lessons as models for teachers to follow. When the database is finally ready for use on the web, parents and students will also be able to access the district’s standards at home to help with homework and to clarify class/course expectations.

## **Assessment and Reporting of Student Progress**

A small group of middle school teachers began experimenting in 1999 with grading and reporting out to students and parents using a standards-based process. This pilot has now broadened to include all core academic subjects at the middle school level and to select elementary schools and high school departments. Teachers began piloting an electronic grade book for reporting on student success at the standards level during fall 2000. The district purchased *Easy Grade Pro* for all teachers in the district following a review of grading software. Previously some teachers had used software programs for grade reporting, but various limitations forced the district to look for a more complete reporting program. *Easy Grade Pro* met this need since it allows more fields for entry of data and a wider variety of options for innovative reporting. District teacher-consultants and classroom teachers have been testing the use of this grading program with the district’s standards and have found it to be very good for current needs. Parents have also expressed satisfaction with the types of information now available to them at report card conferences. However, teachers are still using these reports as supplements to the traditional report card.

During the 2000-01 school year, teacher-consultants began visiting schools to present the overview of the reporting process to all teachers. They utilized a computer slide show, “The Show”, to help teachers begin evaluating what is actually contained in the grades they award. Conversations have been sometimes heated as teachers redefine their philosophies of homework, late assignments, and what it means to reach a standard. Reliability and validity of grades have been discussed throughout the process to get teachers to talk with each other about common (and not so common!) grading practices in the district.

With this slowly growing shift in the thinking about grading, the Kenosha Schools have been working on developing a new grading policy that calls for a separation of the academic and non-academic grades. This shift in grading practice has drawn the most discussion at the district level due to the fact that teachers want to include “penalties” for late work that impact the final grade. The district is trying to move away from this practice so that the academic grade actually reflects what a student has learned and not how well he or she has pleased the instructor or met deadlines that may not be appropriate for all students. In other words, the new reporting system is being developed to show what students know in relation to course standards rather than grades being given that don’t always relate to course content. This grading policy change is still in the works and may face several revisions before finally being adopted.

Because of the size of the district (21,000 students and over 1,700 teachers), the Department of Instruction has faced its biggest challenge in affecting widespread change at a rapid pace. In an effort to bring all teachers on board at the same time concerning developing standards-based grading practices, the district is devoting its single district-wide in-service day this year to practicing how to set up a standards-based grade book. Similar in-services will follow during the 2002-03 school year to make sure that all teachers are ready to begin using the reporting system in fall 2003. Since the current district-wide computer network has not yet been set up for full web access of grades by parents, students, and teachers, training is being conducted on how to report to parents on a more limited basis at regularly scheduled conferences. The district is currently reviewing web-based software options, but funding will need to be planned for at least three years into the future to accomplish a switch in reporting systems. Current estimates of the cost to switch to a web-enabled system are running between \$500,000 and \$1,000,000.

### **Reporting Progress for All Students**

The Individuals with Disabilities in Education Act of 1997 requires schools to provide progress reports to parents in a similar fashion to those of students without disabilities. However, often the activities of students

with disabilities do not lend themselves to traditional evaluation methods. Standards-based reporting processes using electronic means enable teachers to vary their evaluation techniques depending on the needs of the students. Grade book software allows teachers to use multiple grading methods within the same class, while still maintaining the integrity of assessment.

The Kenosha Unified School District, in collaboration with National-Louis University, is undertaking a project to make such standards-based reporting a reality for all parents of the district. A pilot project is also underway to use the Internet to turn the district's Individualized Education Plans into electronic portfolios for students with disabilities. These electronic portfolios will feature parental progress reports identified by the appropriate standard and linked to the appropriate activity from the regular classroom standards report. In an effort to better demonstrate the progress of some students, digital videos will be used in the portfolio as a method for making these reports more meaningful to parents. A CD-ROM format for parents who do not have access to the Internet is being planned, as well as short videotapes for families without access to a computer.

With parental permission, selected videos of assistive technology being used to meet standards will be integrated into the National-Louis teacher education program. These videos will be used in general education technology courses to meet the requirement of the International Society for Technology in Education (ISTE) for students to become acquainted with technology used by students with disabilities. These videos can also be used to meet new requirements in special education teacher education programs found in the new Common Core requirements that include knowledge of assistive technology.

## Summary

This presentation will provide a demonstration of the standards-based reporting program that is being developed for regular and special education students in the Kenosha Schools. Included will be examples of the electronic curriculum notebook, grading software, and plans for developing web-based reporting. This presentation will also demonstrate an example of the pilot portfolios being developed for students with disabilities.

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**TITLE OF THE PAPER: COMPUTER AND NETWORK SECURITY**

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**Introduction**

With the introduction of open standards and communications over public networks, the need for automated tools for protecting information during transmission, as well as that stored on the computer, became evident. In an enterprise network, the idea that the security of the entire network is only as strong as its weakest part is termed the weakest-link axiom. Computer and network security can be defined as the protection of network-connected resources against unauthorized disclosure, modification, utilization, restriction, incapacitation, or destruction. The generic name of the collection of tools designed to protect stored data is computer security, while network security measures are needed to protect data during its transmission. Network security measures may be implemented at different layers of the OSI model. Security implies safety, including assurance of data integrity, freedom from unauthorized access, freedom from snooping or wiretapping, and freedom from disruption of service. This paper analyzes security threats, and outlines the development of appropriate security policy and measures.

**Security Threats**

Hundreds of thousands of systems are now connected to the Internet. There is no accurate way of measuring the threat that may be launched by an inimical agent. Security risks vary from uploading files with embedded malicious code onto a network to stealing information. Each time a company deploys a new Internet gateway, LAN, or distributed client/server system, it risks leaving another virtual window open for cyber-prowlers, disgruntled employees, or unethical competitors to work through. Security threats can be divided into two major categories: passive threats and active threats.

Passive threats involve monitoring the transmission data of an organization. The goal of the attacker is to obtain information that is being transmitted. These threats are difficult to detect because they do not involve alteration of the data so the emphasis in dealing with passive threats is on prevention rather than detection. Although they can be directed at communication resources (routers and lines), they generally perpetrate at the host level.

Active threats involve some modification of the data stream or the creation of a false stream. It is difficult to prevent active attacks because this would require physical protection of all communications facilities at all times. Instead, the goal is to detect active attacks, quickly recover from disruption or delays

caused by the attacks, and possibly pursue legal action against the hackers, all of which have a deterrent effect and may contribute to prevention. These threats are most successful when directed to what could be the weakest link in the overall system, namely, at the host level.

Although the best solution for these threats is prevention, this goal is almost impossible to achieve. The next best approach is to do the following:

- ◆ Detect
- ◆ Purge
- ◆ Recover

### **Security Policy**

Before an organization can enforce security, the organization must assess risks and develop an unambiguous policy regarding access to each element of information, the rules an individual must follow in disseminating information, and a statement of how the organization will react to violations. Establishing a security policy and educating employees is critical because humans are usually the most susceptible point in any security scheme.

### **Security Measures**

Some of the basic security strategies that can be utilized to combat the threats include:

- ◆ Access control
- ◆ Encryption
- ◆ Authentication

The purpose of access control is to ensure that only authorized users have access to a particular system and/or specific resources, and modification of a particular portion of data is limited to authorized individuals and programs. The most effective way of securing the integrity of electronic data is by the use of encryption, which involves scrambling of data by use of a mathematical algorithm so that the scrambled information is undecipherable and meaningless. This can be done at various levels of the OSI model with software, hardware, or both.

Authentication methodologies include: one-way encryption to validate information transmitted, digital signatures that verify both the information sent and the sender, and digital certificates that are distributed by a Certification Authority (CA), to acknowledge the identity of the user.

### **Firewall**

Firewall is a piece of hardware and software, a security device that allows limited access out of and into one's network from the Internet. It operates at the application layer, or at the network and transport layers of the protocol stack. In essence, it partitions an enterprise network into two areas, informally referred to as the inside and outside. Firewalls are classified into three main categories:

1. Packet filters
2. Application-level gateways
3. Proxy servers

### **Security Provisions in a VPN**

VPNs share similar features at varying degrees of sophistication, cost, and ease of implementation. The main components integral to VPNs are: encryption, authentication, and tunneling protocols, where each one provides a different way of ensuring privacy. Combined, they complement and strengthen each other, enhancing the integrity of the transmission and ensuring security. A VPN has three main components:

- ◆ Security gateways
- ◆ Security policy servers
- ◆ Certification Authorities (CAs)

### **Summary**

The manager of a network configures the network, monitors its status, reacts to failures and overloads, and plans intelligently for future growth. Security is of vital concern among both users and network managers; it is indicative of a mindset that believes no system is completely unhackable. An ideal network management system is an intelligent self-learning system that learns what and where a problem can arise and tries to resolve it automatically; and at the same time alerts the network manager and calls attention to any special characteristics of the situation.

# Finding Quality in Online Publications: Observations and Suggestions

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**Abstract:** The explosion of information via the World Wide Web has resulted in a large number of educational research related documents being easily available. Finding appropriate, quality materials has become difficult due to the volume of information available. This poster will review the advantages of online publications and provide suggestions as to how the educational research community can identify important works.

Tim Berners-Lee (2001) had a very simple objective when he developed a system for a *global hypertext space* at the European Particle Physics Laboratory. That objective was to enable the users to share a *common information space*. What is unclear is whether Berners-Lee had considered how unwieldy this space would become in such a short amount of time. Thus, while access is certainly much easier, the determination of what is *worth accessing* has become incredibly cumbersome.

Like the physical scientists at that laboratory, educational researchers are also interested in sharing important documents. (The use of documents is a bit of a misnomer since we are truly interested in information in any form, however, in the present state of educational research, the document, or paper, is the standard unit). Currently we share documents in an extremely cumbersome manner – via peer reviewed, hardcopy journals. The problems with this system of distribution are numerous (for a brief review see Glass, 1999) and the movement away from it towards a Web-based distribution system appears inevitable. As we move away, it is important that we recognize what the current system does well and attempt to retain those characteristics while also taking advantage of the new opportunities provided by electronic distribution. One thing that this system does well is to establish the important works in our field. What becomes considered an *important work* begins with acceptance into, of course, an *important journal*. Once in the important journal, it is read by the *important* scholars in the field represented by the journal. These scholars then refer to this important work in their subsequent articles. While on the surface this may seem a bit innocuous, it works quite well.

The key steps in the process outlined above include the peer-review and then the subsequent citation. As we move to the electronic distribution of our work, it is essential that we retain these characteristics in a meaningful, and possibly improved manner. The peer-review can easily be accomplished in a manner that is equivalent to, and possibly superior to, the way it has been done in the past. It may be improved because the distribution of review copies becomes much more efficient and thus more reviews are possible (Glass, 1999). The second component, the citations, can also be completed in a similar manner. It is this second component that, in the world of electronic publishing, can be taken to a much more sophisticated level. To explain why requires a brief digression into the world of Web search engines.

Most Web search engines depend upon matching terms provided by a user with terms found in the Web page (Sullivan, 2001). Simply matching the terms often results in a very large number of results. The search engine will then rank the results based upon some algorithm that looks at the frequency and location of the words in the Web page. The Web search company Google ([www.google.com](http://www.google.com)) has quickly become the leader in this field by using a very different, yet effective strategy based a system called *PageRank*<sup>TM</sup> (Google, 2001): PageRank relies on the uniquely democratic nature of the web by using its vast link structure as an indicator of an individual page's value. In essence, Google interprets a link from page A to page B as a vote, by page A, for page B. But, Google looks at more than the sheer volume of votes, or links a page receives; it also analyzes the page that casts the vote. Votes cast by pages that are themselves "important" weigh more heavily and help to make other pages "important." (p. 1)

An interesting comparison can be made between the PageRank<sup>TM</sup> system and the identification of important works in educational research. The Social Sciences Citation Index (SSCI) is a highly valued resource that provides (albeit indirect) some measure of the importance and quality of an article by listing the number of times an article is referenced by other articles in important journals.

The purpose of this poster session will be to present a Web-based tool that can be used to perform a similar function for online publications relevant to educational technology research.

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# Designing, Implementing and Maintaining a Web Site: Issues and Technique Tips

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**Abstract:** This paper will address a series of issues, problems and solutions, and useful technique tips in designing, implementing, and maintaining a college Web site. The author of this paper is the Web manager and has worked on every single task through the entire development processes of this college Web site. Generally, developing a Web site is all about information and technology—using technology to organize and display information in an appropriate way to meet the purposes of the Web site. This paper will also present some useful strategies dealing with Web design, such as the structure of the site, function of navigation and orientation, the control of page loading speed, use of graphics, screen structures, file management, information collection/selection and administrative problems that a Web manager may be confronted with. These experiences and technique issues/solutions could be useful for those who design or maintain an educational institution Web site, and those who are teaching web design courses.

## Introduction

When a student is to decide which university he/she will apply for to continue his education toward an advanced degree, he needs to search for the information of programs, course settings, or application requirements and procedures from different universities. When a new graduate is about to accept a job offer from a school or company, she would like to find out more details about his/her future working environment. When faculty members develop a new course or program, they might need to review what has been done in this field. To obtain the information, obviously, the Web is the first information resource they would choose. In this digital age, people depend more and more on the Web for information related to almost any aspects in their life. The question is to what extent the Web sites could provide valid information people need, which is one of the most important issues addressed to the Web developers. This paper will, from a Web manager and developer's view, introduce the processes of redesigning an informative college Web site, and discuss a series of issues, problems and solutions, and useful technique tips in designing, implementing, and maintaining the site.

## Purposes of the Site

The Web site introduced in this paper is the site of our College of Education. It had an old version that was developed years ago. The purposes of redesigning it were: First, we intended to use it to provide more information for students who want to apply for our programs, and for people who want to know more about our faculty, resources, technology facilities and so on. Second, we considered it an efficient way to show the mission/vision and the conceptual framework of the college, to show the strength of our programs, advantages of our resources. And the third purpose of redesigning the Web site was to establish a new and fresh image of the college for the NCATE evaluation, and to provide NCATE evaluators an easy path to find the information about the college (The Web site did play a useful and important role for our high scores in the NCATE evaluation).

According to these purposes, the development of the Web site, from the site structure to page/screen details, emphasized on two major principles: (1) valid and adequate information, and (2) clear and easy navigation, which are the basics to ensure an effective information resource.

## Structure of the Site

After reviewed the purposes of the Web site, the next issue was to determine the structure of the information, and the structure of the Web. The structure of the information indicated the way to organize original information such as text files, data files, html files, graphic files, and other Web resources; this was an issue of file management. The information should be organized by category so that any future Web manager or current co-manager can easily find the files to edit or update. Therefore, the structure the information was redesigned in three fashions: (1) by administrative structure, that is, administrative divisions, departments, and centers; (2) by program, including all undergraduate, certificate, masters, the doctor programs; and (3) by faculty, including faculty contact information, courses taught, research areas, and publications. Figure 1 is an example of the file structure:

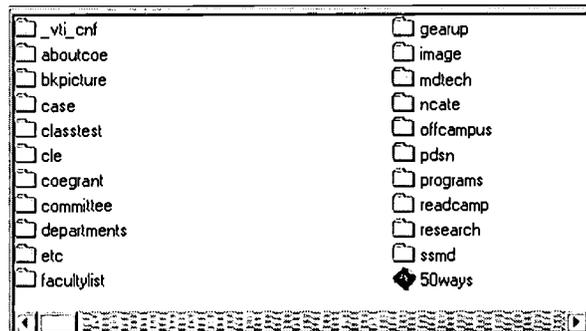


Figure 1. File Structure of the Web Site

The structure of the Web was the way to navigate the information. The navigation should provide all possible paths to all information. One technique issue was how to merge the three structures smoothly into one site so that people could find information easily by departments, divisions, programs, courses, faculty, or other categories. Figure 2 shows an example of the Web structure, which is different from the file structure. Another technique issue was that during the redesign and restructuring process, we need to maintain certain consistence of the paths, file names, links from the old site, because they had been used for many external Web sites and quoted as references by instructors.

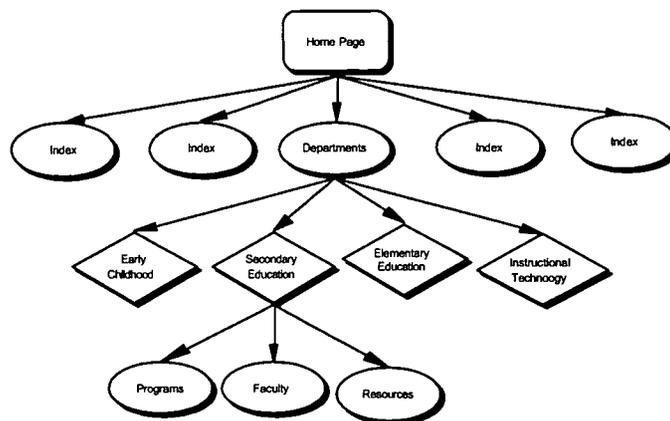


Figure 2. Example of Web Structure

During the redesign of the Web site, the author found out some useful and practical Web design tips, some which as introduced in the next section could be used as the solutions to these two structure design issues.

## Web Design Tips

### Navigation and Orientation

In the design of site navigation and orientation, index page, navigation table, and site map were used. In the home page, buttons with links to different information categories were created – to administrative departments, programs, faculty and other categories. However, the links do not directly link to the specific page; they link to the second level pages – index pages. Index pages are the place where we put the links to specific pages that contain the information of the same category. For example, the “Departments” index page includes the links to the four departments in the college; from there, people can go to each department. The index pages should have the same style of screen designs. As in Figure 3, they have the same style of title design; people will easily see where they are.

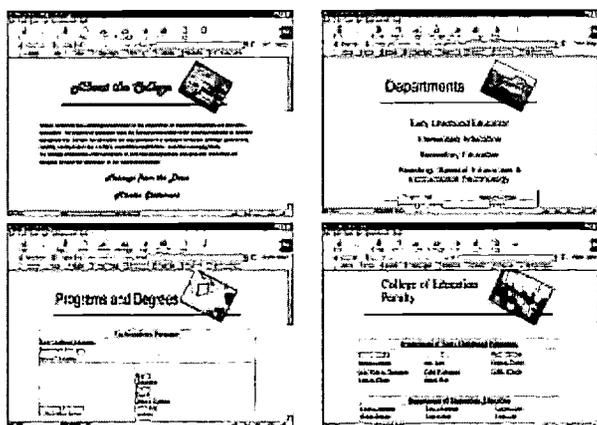


Figure 3. Examples of Index Pages

Then a navigation table (Figure 4) containing links to all the index pages were included in all the major pages within this Web site, which makes the easy paths to anywhere within the site. Also, a site map that navigates through the entire site is necessary and always helpful; it provides not only the links to all the major pages, but also the structure of the site. Index pages, navigation table and site map are three useful methods to merge information of different categories into the site and make the navigation clear and easy.

<a href="#">COE Home Page</a>	<a href="#">Academic Departments</a>
<a href="#">Programs and Degrees</a>	<a href="#">Faculty</a>
<a href="#">Centers and Resources</a>	<a href="#">Faculty Scholarship</a>
<a href="#">Off Campus Programs</a>	<a href="#">Map of the Page</a>

Figure 4. Navigation Table

When redesigning the Web site based on certain information from an old site, to certain extent, the old structure still needed to keep. Some folder names, even file names were used as they were. In this way, the URLs to certain important pages did not change, and meanwhile, we added a lot of new information. The index pages were used to organize the site structure, but the file structure kept as less changes as possible from the old site.

### Page Screen Design

In the page screen design, to arrange the texts, graphics, buttons, or any other objects to certain position, traditionally, people use frames to separate the page into several areas and hold different objects. For example, title frame at the top of the page, side menu frame on the left or right side of the page, and the main frame to hold the major text or graphic – the three frames are three files when you create the page. One disadvantage of

using frames is that, if the visitor wants to print out the page, he/she might just be able to print out the single frame (the single file) where the mouse pointer is on. One method that could produce the same or even better effects is to use table. We may create a table and set the border to zero, then set different colors as the background of the major cells. In this way, the table cells separate the screen into several areas, and all areas are still within one file. This will also make the file management work simple—one file for one page versus three or more files for one page.

Currently, pages on the WWW contain the information of the institution name and address, contact person, date of last updating and some other general information related to the site. Besides, one important thing is the URL for the current page, especially when the page provides information for visitors to download or print out. They need the URL as the reference resource for future use. Whether the page URL can be printed out automatically at the bottom or top of the page depends on the default set up of the browser software (Netscape or Explorer) on that particular computer. It may or may not automatically print out the URL. Therefore, when we complete one page, the last thing is to put the URL of that page at the end.

Every page should also include contact information, which can be E-mail link or contact firm. If using contact form, a clear path is needed to where the input information would be collected. The form input information could be sent to either the email address of the Web manager or the relevant administrator, or a server database.

### Use of Images

Almost all the Web sites have images, pictures, or graphic designs. One issue of using images is the file size. One useful tip of using images and reducing image file size is that use one single image file instead of multiple files. For example, when you need to use a set of pictures, you group them all into one file. The file size of this grouped picture is much less than the sum of all single image file sizes. In Figure 5, the top picture is a grouped picture file with five pictures, and its file size is 20.1KB; the picture below is a single picture, and its file size is 12.8KB. Obviously, if we use five separate single pictures, the sum of the five files' sizes would be around 60KB. And, as we know, the smaller the file size, the faster it is loaded to the page.



Figure 5. Image File Sizes

Using image is a major factor that influences the speed of the site. Especially, when using JavaScripting to load random images, display rotating images, or produce animations, the loading speed is very much slowed down. Sometimes, people use these new skills to create fancy effect, which does not always fit the purpose of the Web site. Therefore, images or special effects should be used only when necessary.

Another issue of putting images on the Web is the copyright issue; do we have the permission to use it? Especially, when we use real person's picture, or use the pictures found from the Web. Generally, we do not use pictures copied from other Web site into our pages. And we need to obtain written permission from the person to use his/her picture.

### Download Option

If we have a document site, text based page, we may use hypertext to organize the sections, subtopics, or even paragraphs. But, remember that people may want to have the entire document (e.g., the course notes, or

application requirements). Therefore, in a document site, we always provide a download option, or an option to print out the entire document in an easy and direct way, so that people do not have to print out them section by section, and if the site is non-linear hypertext, people may get lost in certain places.

To do this, first we create a link to the word file, and then upload the word file onto the Web. When people click on the link, the browser either launches the word processor for people to open and print the file, or provides an option to save the word file into the disk.

### **Tricks of File Name and Folder Name**

There are some other technique tips that the author found useful and effective to enhance the quality of the site. When we work on the pages, one very basic step we may perform hundreds of times is to save the page file into certain folder, and FTP them to the Web. Sometimes, everything works perfectly on the local, but the links are dead after they are uploaded on the Web. One cause of this might be, very often, that when you create the files and folders, if you type the names in a upper-lower keys format, when they are FTPed to the Web, all the file names or folder names become all upper keys – that is, all capital. Sometime, if the file name or folder name consists of more than one word with space between, after they are FTPed to the Web, the space usually is interpreted as 20%. For example, if we use a file name “project one”, it would be interpreted as “project20%one” after transferring to the Web. Therefore, the hyperlinks can never find the right folder and right file to link with. A simple way to avoid this is that we always use all-lower keys and one word for file names and folder names, with NO spaces in the names.

### **Strategies of Duplicating a File or a Site**

There are several ways to duplicate a file such as “Save As”, or copy. Our experiences suggest two best ways to do this: (1) use Windows Explorer to copy the file, and (2) use FTP to download it directly from the Web. The worst way is to use “Save As” (open a file and then save it as a new file in another folder)– this is very likely to change all original link paths on that page to local paths such as C:\foldername\..., when the link paths are uploaded to the Web, again, the hyperlinks can never find the right folders or right files to link with. Because there is NO such a path C:\ foldername\... on the Web.

## **Information Collection and Administrative Roles**

The above sections introduced some very practical technique skills to create a Web site as an effective information resource. However, developing a Web site is about “information + technology” and the hard part is the information collection. A Web manager may not have the power to obtain any information effectively from the departments or faculty members. According to the author’s experience, one efficient strategy is to work with the Dean and department chairs, and get all faculty involved. For example, when the author was working on the faculty pages that reflect faculty members’ accomplishments, most faculty were very supportive and provided information for their short vita page.

## **Maintaining and Updating Work**

After the Web site was published, the work of maintaining and updating the pages was an every-day work. A plan of updating the pages was developed and implemented for the academic year 2000-2001. Basically, the updating work was cooperated with program directors, administrative managers, and individual faculty members. Program information was updated by semester, and individual faculty page by academic year. Also, individuals were responsible for maintaining and updating the information linked from their pages.

This Web site <http://www.towson.edu> also was used as an example to demonstrate certain basic Web development skills to a “Web Based Instruction” course taught by the author. It is the author’s hope that these experiences and technique issues/solutions could be useful for those who design or maintain an educational institution Web site, and those who are teaching web design courses.

## PhoneChannel: Bridging the Digital Divide with Ubiquitous Technologies

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**Abstract:** The Institute for the Advancement of Emerging Technologies in Education (IAETE), in cooperation with AT&T Labs, completed a pilot study in Calloway County, Kentucky, to explore the use of ubiquitous technologies (i.e., telephones and televisions) to increase teacher-parent communication. PhoneChannel enables teachers to push visual information from a computer to a family's home television. Concurrently, the teacher and parent talk by telephone about the items displayed on the screen. This allows the teacher to communicate with underserved families who do not have access to a computer. The pilot study confirmed an increase in communication between school and home, and this unique application has breathed life into two common technologies now poised to become more powerful tools in education.

Many teachers have access to computers that can be used to communicate with parents, but parents without home computers cannot benefit. The Institute for the Advancement of Emerging Technologies in Education (IAETE) and AT&T Labs are using PhoneChannel to explore the use of ubiquitous technologies (i.e., telephones and televisions) to increase teacher-parent communication.

PhoneChannel is a new communication service that allows a teacher with Internet access to display visuals on a family's television while talking by telephone. For example, a teacher could call a parent, ask him or her to tune to channel 77 on the household television, and display a student's schedule, projects, or homework. The telephone provides a way to convey socio-emotional information in real time, thereby allowing attunements to establish trust. The television enables the sharing of visual information to establish common ground and increases trust by reducing uncertainty related to task-oriented information.

Originally studied in e-commerce environments (i.e., real estate and catalog shopping), PhoneChannel was recently pilot studied in a school setting. Calloway County, Kentucky, is a large, rural county in the southwest part of the state that has identified increased parental communication as a goal for improvement. Student households are widely distributed across the county, and distance is a significant barrier to successfully engaging parents in school meetings and conferences. In addition, 43 percent of students (10 percent more than the national average) live in a single parent household where involvement is typically minimal.

The pilot study utilized a teacher at each of two elementary schools, one of which is designated Title I. Each teacher used the PhoneChannel application to augment school-to-home communication while maintaining more traditional means, such as written notes, phone calls, and face-to-face meetings. The teachers recorded their school-to-home communications by type and frequency and rated perceived quality and effect.

Several factors encouraged the successful deployment of the PhoneChannel application in Calloway County. Preliminary surveys of target classrooms indicated that all student households had at least one television and all but one had telephone access. All classrooms in the two schools had telephone access, and teachers used computers in their classrooms on a daily basis for instruction, lesson preparation, student management, or communication. The PhoneChannel application required minimal new technology competencies beyond teachers' existing skills. Also beneficial was Calloway County's use of student portfolios, easily shared via PhoneChannel.

The Calloway County pilot was a key step in the evolution of a large-scale study in an educational setting. Moving the application from the laboratory to the field, it was important to negotiate and adapt to the realities of delivering secure information over a cable television infrastructure. The realities of cost models and proprietary system protocols were compounded through the need to transmit the PhoneChannel signal over two different cable companies. Representatives from Charter Communications and MediaComm in Calloway County worked with the researchers and developers to establish a working solution to transmit information originating outside the cable network to subscriber homes. Future delivery of PhoneChannel will owe a great deal to this pilot study, regardless of whether it is transmitted via cable television, broadband cable modems, the Internet, or satellite.

The pilot also helped to establish some user perspectives on the types of communication that are effective when using the PhoneChannel application. School personnel reported that if the Internet connection was reliable, the system was very easy to use. In fact, one school technology coordinator who was going to offer technical support during a session discovered that the teacher and parent were already using the system when she arrived. School personnel generally agreed that teachers could run the system on their own and could even use it from home computers.

While the original intent of the educational application was to share artifacts from an electronic portfolio, school personnel involved in the pilot offered several common school-related activities (e.g., discussing assignments, demonstrating progress, delivering reports, sharing discipline referrals, etc.) that could benefit from delivery via PhoneChannel. The District Technology Coordinator named three student populations in which PhoneChannel could make the greatest impact: night class, alternative school, and homebound. In the case of homebound students, teachers work one-on-one and spend much of their time on the road between homes. PhoneChannel could eliminate much of this travel time, which could be spent on instruction.

The greatest difficulty in terms of implementing the system was finding time to accommodate the call. While the physical system worked well, parents simply are not home during the school day when teachers are working, and the existing structure of the school day does not compensate teachers for working outside school hours. Several solutions were provided, including trying to schedule PhoneChannel conferences during teacher planning times, installing the system on teacher home computers or school laptops, and investigating novel scheduling practices. Some schools schedule half-day or part-day parent conference days, which still occur while parents are not commonly at home. In order to contact parents not available during that time, schools could consider giving teachers release time and teachers could log comparable time on the system at night. All use would be logged by the server and would be very easy to corroborate actual time spent.

During the trial, one feature of the system was discovered that had not been discussed earlier. Documents that were pushed to a home were stored in an archive. Home users could view these documents from their television at any time, regardless of whether they were involved in a session. The archive was accessible using the remote control from the set top box. This archive generated further suggestions for solving the difficulty of scheduling. Teachers could push items to the student archive during their planning period and discuss the items at a later time when the parents were home. Another option, parents could view the archived documents at night and discuss the documents with the teachers during the day by telephone only during a prearranged call, such as during the teacher's planning period. Use of the archive feature holds great potential for increasing the effectiveness of the PhoneChannel system and merits further investigation.

While the pilot study relied on cable dissemination, a variety of delivery modes are possible in subsequent applications—including wireless transmission. PhoneChannel also has opened the door to a variety of education-related activities that are not limited solely to traditional classroom support. Based on this preliminary study, it appears that service providers could use PhoneChannel to support adult and family literacy programs, ESL programs, distance-based and distributed learning and training, and services for disabled and underserved users. This unique application has breathed life into two common technologies now poised to become more powerful tools in education.

## The Place of Internet-based Architectures in Supporting the Professional Practice of Teaching

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### Abstract

This paper describes the varied technologies and on-line architectures that serve to meet the needs of practicing classroom teachers and the ways in which they can meet those needs. The focus of the research is on teacher professional development and online technologies. The symbiosis between education reform and the integration of technology into learning is profound: technology requires the rich learning environments envisioned by reformers; reform demands the power of technology to put people at the centre of their own learning. (Serim, 1996, p.1) Having established that there is value in community development and its potential for ongoing professional support, it is important to examine the circumstances under which the community of practice could effectively go on-line. It is equally necessary to review all the Internet-based architectures and the strength of each in supporting classroom practice. This review and analysis of architectures will help to refine the concept of 'on-line community' and to shape and place value on all the current Internet architectures.

### Supporting Classroom Practice

In-service teacher needs in relation to ICT can be summarised into relation to three main issues:

- Hardware and connectivity - support and maintenance
- Professional development - recognition and accreditation
- Equity of access to quality resources

As hardware and high speed connectivity becomes more readily available in classrooms, educators need to focus on the issues of support, ongoing professional development, recognition of ICT skills and leadership, accreditation for high level skill development, access to high quality resources and equity delivery formats and languages.

The National Foundation for the Improvement of Education report *Teachers Take Charge of Their Learning* (NFIE, 1996, p.1) asserts that; "*to improve student achievement, public schools must weave continuous learning for teachers into the fabric of the teaching job. This work can and should be initiated by the teaching profession itself in partnership with other educators, communities, districts, and states*". There is an imperative for new professional development strategies and for teachers themselves to take control of their personal professional development. For the past ten years it has been recognised that a 'culture of collegiality' is required. This can be achieved through an environment where teachers teach teachers in a supportive network of practice. (Little, 1993; Lieberman & Miller, 1991; Warren & Roseberry, 1992). There are no simple remedies, but it does seem understood that communication and collaboration are two of the keys.

## Current Internet Architectures

It is important to clearly determine what are on-line communities, as Brown (1999, p.1) cautions “Community is quite possibly the most over-used word in the Net industry. True community – the ability to connect with people who have similar interests – may well be the key to the digital world, but the term has been diluted and debased to describe even the most tenuous connections, the most minimal activity”.

Terms like *portal*, *hub*, *network* and *interest group* are all used interchangeably with the term *community* to describe involvement with Web site. These structures or architectures are arguably distinctly different in what value they offer for on-line users. Kanfer et al (1997, p.1) offer a useful distinction between the ways that humans access information and support. *Traditionally, there are two different sources from which human beings access information: broadcast or mass media, and interpersonal communications.* Building on Kanfer’s distinctions we can map current Internet architectures (Stuckey et al, 2001) and the levels and directions of possible interactions within those architectures. Table 1 maps these architectures and possible interactions against Kanfer’s high-level divisions. All implementations of web architectures can be described as primarily broadcast or interpersonal.

Broadcast <i>One to many – central source to large audience uni-directional</i>		Interpersonal <i>One to one/ among people/ many to many bi-directional</i>		
Web site	Portal	Network	Interest Group	Community
Resources & Services-based		Communications & Relations-based		Collaboration-based

**Table 1:** Mapping Internet Architectures against broadcast and interpersonal delivery models

In order to build a deeper picture of the information contained in the map presented in Table 1, we need to examine in some detail each of these web architectures to define and distinguish each, to explore examples of each and to propose how each can meet the needs of professional teaching practice.

### Web Site

A Web site can be defined as a compilation of pages created in programming codes such as HTML, DHTML, XML and ASP produced for display on the World Wide Web. The purpose of a web site is largely informational, promotional and/or marketing. The content can be static or dynamically delivered from a database and offer search options. There is usually neither membership nor access to others interested in this topic. Users who visit the site are usually passive consumers. Data might be trapped about users through cookies and visitor’s books but this is data known only to the site developers. For the owner’s success of the web site might be judged by hits on the site or contacts made with the developers or the visitor’s book. Examples are too numerous to outline but we offer a few popular educational exemplars, which deliver varied media and technologies within the site architecture and are working towards accessible design.

- NASA <http://www.nasa.gov>
- How Stuff Works <http://www.howstuffworks.com>
- Sydney Opera House <http://www.sydneyoperahouse.com>
- Discovery Channel <http://dsc.discovery.com/>

### Portal

The Oxford Dictionary describes a portal to be a *doorway or gate*. An Internet portal is a gateway to an aggregation of approved, categorized and/or indexed content, resources and services. The purpose of a portal is to become the first port of call for broadcast of content for users within a topic or domain. The site is often database-driven with some level of automated updating and the design may allow for customisation of the interface or records. The most effective portals offer some level of review and approval of the sites and resources that access is given to. It is this filtration, distillation and annotation of the Internet resources that gives true value to the portal for teachers. The site may offer membership or registration but users will have little or no access to other members. The users are still consumers but may

be able to contribute sites and resources for review. Success for the owners of the portal is measured in numbers of hits on the home page. Examples are resource libraries, link sites, media databases, search engines and intranets (HR). Consider these sites:

- PT3 Digital Equity Portal <http://www.digital-equity.org/portal.cgi/>
- Texas Public Education Portal <http://ritter.tea.state.tx.us/>
- Science Education Gateway <http://csc.ssl.berkeley.edu/SEGway/>
- Education Network of Ontario <http://www.enoreo.on.ca/>

## Network

A network can be defined as people connected by exchange of information. It is useful to also note the television metaphor as a group of broadcasting stations connected for simultaneous broadcast of a programme. The network is largely still a broadcast mode of delivery of content and services delivered from one to many or in one direction. A network may involve database delivery of content through a portal and some leader to member communication. Members will be unable to establish communication with other individual members of the network. Content is administrator controlled and users may contribute through moderated technologies. Success may be measured in numbers of members and hits on areas of the site. Only weak ties may be established while members remain largely anonymous in many on-line networks. For the members the involvement is individualistic and will be a general interest or 'keeping up-to-date' focus. Examples of networks include web and portal sites with added and varied technologies such as listservs, newsletters, discussion boards, forms for limited data collection or member contribution to the site. Consider these sites:

- Learning Network Family Education <http://www.familyeducation.com/home/>
- Education Network Australia <http://www.edna.edu.au>
- Idealist.org <http://www.idealists.org>
- EnviroLink Network <http://envirolink.netforchange.com/>

## Interest Group or Special Interest Group

This is a familiar organisation to most teachers and special interest groups or SIGs often form at face-to-face get-togethers and conferences in order to support specific areas of teaching practice or needs. There is on-line a two-way communication focus and this may be one to many or one to one.

Focused discussions there may be moderation from leader not necessarily the owner or administrator of the group. Registration and membership is essential and usually under some scrutiny and approval process. Members are rarely anonymous, whether they use real names or nicknames and pseudonyms a real persona is developed over time. On-line the SIG ties will be stronger than on a network and members contribute not only with communication but also with resources, ideas and leadership, an interest group offers communication between members about those specific topics. The communication is more than sharing; it is support for each other's practice through facilitation, leadership and mentoring. Success might be measured in numbers and types of issues and responses/ratings. Interest groups use technologies such as listservs, discussion spaces and member upload and review of resources along with advanced communication and face-to-face opportunities. Special interest groups include user groups, associations, fan clubs (ezines) and tightly knit demographic groups. Consider these sites:

- iEarn Homepage <http://www.iearn.org/>
- OzTeacherNet <http://www.rite.ed.qut.edu.au/oz-teachernet/>
- American Educational Research Association Special Interest Groups <http://www.aera.net/sigs/>
- Special Education Technology SIG (SETSIG) <http://www.iste.org/setsig/community.html>

## Community

*A community of practice is different from a network in the sense that it is "about" something; it is not just a set of relationships. It has an identity as a community, and thus shapes the identities of its members.* (Wenger, 1998, p.4) Putting people together in a place real or virtual does not make a community. Loosely bound collections of people in groups on the Web do not make communities and most certainly not communities of practice. People in true communities collaborate, teach and mentor each other, solve problems and build solutions together; they do so much more than just communicate with a site

administrator, leader or each other. In a community members are producers, consumers and builders. The communication is multi-dimensional and there is strong reciprocity. Real names are more likely to be used and even insisted on. The members share team projects/activities and develop joint artifacts. Communities are not built they grow through personalisation, member participation, contribution and most importantly ownership (van der Kuyl, 2001). They can effectively be used to leverage tacit knowledge from and between members of the group. Designers can establish frameworks, architectures and spaces to promote or facilitate certain activities and interactivity but it is the members who build the sense and value of community. As Preece (1999, p.3) explains “communities develop and continuously evolve. Only the software that supports them is designed”.

Wellman & Gulia (1997) have used the terms ‘social networks’ and ‘community’ interchangeably and the Howard Rheingold has adopted ‘on-line social networks’ (Kimball & Rheingold, 2001) to describe organisational groups. These blended terms represent attempts to clarify and distinguish the Internet communications that have arisen and to give due separation to the quite rare true community. What distinguishes a true on-line community from an interest group is when the collaborative projects and activities arise from the sharing and support within the group. When members take up the varied roles offered to them and work with others in the community to develop new resources, projects, form consortia, apply for grants, then we can truly say that we have established community. Communities evaluate their performance through more qualitative measures than do most other interactive structures. While numbers of members and resources might still be important to a community, it is the quality of interactivity and collaboration and the rate of adoption of leadership, mentoring and facilitation roles that is its true measure of success. Consider these community sites some not fully fledged but burgeoning:

- Tapped In <http://tappedin.org> (community of communities)
- StageStruck <http://www.stagestruck.uow.edu.au> (interest group aiming to build community)
- SITE Community Forum – Learning Communities  
<http://www.aace.org/site/forum/categories.cfm?catid=17> (International collaboration for SITE02)
- MirandaNet <http://www.mirandanet.ac.uk/>

### The Value Of Internet Architectures to Classroom Practice

These architectures, while as suggested are not mutually exclusive, represent a shift in focus and in the dimensions of interpersonal communication and interactivity. This increased development is shown in Diagram 1 but it is worth noting that there is at present conversely a decrease in the proliferation and use of such architectures as we move towards interest groups and communities.

Web site	Portal	Network	Interest Group	Community
<b>Developing and strengthening interpersonal ties through:</b>				
<b>Increasing</b>				
• role development for users	_____			
• contribution by members	_____			
• ownership by members	_____			
• sense of identity	_____			
• collaboration in joint tasks	_____			
• timeline for growth	_____			

**Diagram 1:** The development of interpersonal ties through the respective Internet architectures.

A community has collaboration as its focus and offers experts and novices varying roles and ways to communicate, contribute, initiate ideas and devise joint projects. A community can develop from one of the Web-based communication architectures if greater levels of functionality, input, responsiveness and group task development are made available to the members and if this is what the members require. An intended community can become an interest group or a network if the members do not take up active involvement and leadership roles. Networks and Interest groups are interactive on-line structures in their own right, structures of merit and value to the membership. Each is also a possible developmental stage in the building of a community. You can design and build a network or an interest group but you can only enable the members to grow a community.

	Web site/ Internet	Portal	Network	Interest Group	Community
Focus	Information	Access	Sharing	Support	Collaboration
Use	Background study Research Email Media collection Building resources Publishing	Vetted information Quality resources Lesson plans Web sites Courses/ training Projects Competitions Product reviews	Updates & FYI Newsletters Contacts New ideas Organisational or system information	Connections Discourse Advice Support Knowledge exchange Sharing experiences Affirmations	Teamwork Initiating joint projects Peer review Innovation Mentoring Scaffolding Leadership Recognition

**Table 2:** Teacher use of the current Internet architectures

Groups and institutions planning to employ on-line architectures need to know what it is that teachers need, resources, communication, collaboration or a combination of all of these to decide which architecture will best meet their needs. The lower cost and more automated nature of a portal makes it an attractive option yet in another context the dynamic supportive nature of the interest group makes it most attractive. It is the needs of the teachers that must be understood before the technology is chosen. Educational Internet product and service developers need to ask themselves whether teacher needs will be met by access to resources or to each other and at what level and intensity.

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# The Transformation, Reform, and Prospect of Distance Education in Taiwan

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**Abstract:** Taiwanese government has emphasized education reform in the past few decades and has focused particularly on distance education. Several legislative initiatives involving distance education have recently implemented new policies governing distance education. These new policies are in opposition to the results of research accomplished in foreign countries regarding distance education and underscore an urgent need to examine the feelings and attitudes of students, instructors, administrators, policy makers, and related employees about the new policies for distance education in Taiwan. The purpose of this study is to determine the attitudes of students and teachers regarding the new policies controlling asynchronous distance education and distance education degree programs in Taiwan. The outcome of this study will improve the effectiveness of distance education teaching and learning, and will support appropriate academic standards for distance education in the Taiwanese learning community.

## Introduction

Taiwan has experienced an economic miracle over the past two decades and her computer industry has been an integral piece of this economic success. The country's burgeoning gross national product has allowed the government to infuse large amounts of money into educational reforms, particularly into distance education. Several policies regulating distance education have been implemented under the aegis of the Asynchronous Distance Education Regulation (MOE, 1999).

## Current Status

Distance education (DE) plays an important role in the history of educational technology in Taiwan. The purpose of DE in Taiwan is to promote societal education to fulfill lifelong learning goals. It is intended to achieve the goal of equal education. Confucius' philosophy, "to provide education for all people without discrimination," has greatly influenced DE. One of principles of DE in Taiwan is "school admission is open; evaluation is solid; and graduation is rigid." The intention is that "everyone has chances to get education; everywhere is a classroom."

School entrance examinations limit the opportunities to pursue a higher education. Each year more than 100,000 high school graduates take the examination. About 60% will pass and get admitted to colleges. The establishment of National Open University in Taiwan (NOU) provides a different venue for citizens to pursue higher education.

NOU students are typically married, middle class, and with incomes slightly below the national average (NOU, 1999). The specific reasons given for participating in NOU's programs include augmenting knowledge and skills, pursuing personal interests, raising personal educational levels, enjoying the social aspects associated with university, and increasing the chances for job promotion.

Three important periods of development of DE are identified (Chu, 1999): (a) Broadcast radio & television instruction, (b) Broadcast television instruction, and (c) Computer-based instruction.

The development of DE in Taiwan began in 1966 with the establishment of an educational radio station and began with a trial of the "School Over the Air." In 1971, the first open learning institution in Taiwan the "High School Over the Air" was established, and in 1973 teachers' college courses were offered over the radio to meet the vital need for elementary school teachers. In 1977, the "Junior College Over the Air" was established to provide alternative schooling and continuing education to adults and broadcast television became the main medium.

During the period between the 1960's and mid 1980's broadcast radio and broadcast television were the major media of instruction with the latter becoming dominant in the 1980's. Such televised instruction is supplemented with correspondence education and a limited number of face-to-face (FTF) instruction sessions as well as other technological and instructional support to provide feedback and interaction. The focus of this period was at first aimed at providing an alternative for the general public to receive education beyond the compulsory secondary education. As the education level of the general public moved beyond secondary education the focus switched to provide avenues of continuing education to adults with an emphasis on providing college and university level courses and to promote the idea of lifelong learning.

NOU in Taiwan was established in 1986, offering humanities, social sciences, business, public administration, living science, and management and information.

In the early 1990s, the third generation of DE, which utilized advanced CMC technology to provide interactive instruction evolved.

NII (National Information Infrastructure) Project, one of the major educational technology plans, identified/categorized DE into three different modes: (a) Real-time multicast systems (RTM); and (b) Virtual classroom system (VC); and (c) Curriculum-on-demand (COD) system utilizing technology. Under the NII Project, seven national universities are initiating interactive DE courses. The focus was the establishment of instructional systems on different communication carriers, computer-based virtual classroom systems, and developing multimedia course materials (Wei & Su, 1997).

This interactive DE project utilizes a multimedia teaching environment through the use of audio/video and computer technologies, such as A/V facilities, video processing, echo handling, CAI, room design, and related setups, to create an excellent educational activity. Educational activities focus on two main issues, teaching techniques and production of computer-based teaching material.

Although RTM has become a popular mode, MOE (1999) announced a regulation for planning asynchronous instruction that includes three requirements: instruction design, delivering methods, and production of course materials. Methods of delivery that are allowed are videotapes, video CD, the Internet, cable, or satellite broadcasting, and videodiscs. Interestingly, regardless of the type of medium "teachers' images and voices must be shown, suggesting that the favored mode of delivering instruction is through lectures. Additionally, instructors must post their office addresses and allow students meet with them either in FTF or through real-time online communication to increase course interaction. Clearly, the authority transfers traditional instruction design to DE.

## **Attitude toward to DE**

Taiwanese education developed in a traditional Confucian way: rigorous examinations, creation of elite higher education institutions, and teacher-centered learning. This belief leads the development of DE in Taiwan to be more conservative while the Open University in Hong Kong demonstrates a more student-centered belief (Sherritt, 1999) although both schools share similar/same Chinese cultures. In fact, Huang (1997) argued that in Taiwan older learners are not attracted to and do not learn effectively in a traditional environment. Additionally, NOU has been categorized as a supplemental education system, which implies a somewhat marginal position in the whole education system. Data indicate that NOU graduates enjoy enhanced quality of life but seldom use their educational attainment for conational advantage.

Further, less than half (45%) of the graduates from the NOU feel that their academic achievements are fully appreciated by their families or their employers (Li, 1996). This suggests that although DE has made great inroads, the belief persists that qualifications from NOU are second class. Hsieh (1996) found that DE had positive influence on labor force skills development and economic growth.

Tu (2001) concluded that Taiwanese students have positive responses to CMC in distance learning environments. Hsiung and Tan (1999) found similar results and concluded that Taiwanese perceived computer Internet systems as interactive and effective communication media in the distance-learning environment.

## **Difficulties and Challenges**

Challenges are identified in the DE system in Taiwan that must be resolved to advance the system, but the prospects for DE in Taiwan are promising (Tu & Twu, in press). Effective reforms require thorough cooperative efforts from students, faculty, staff, administrators, institutions, policy makers, governments, and all others.

### **Need driven rather technology driven**

Current DE development has put more weight on the attributes of delivery technology than the needs of students. Certainly, obtaining hardware and technologies is necessary to the initiation of the reform process; however, it is necessary to examine what students need to learn, how they would like to learn, and how their learning experiences can be enhanced.

### **Course design**

Effective course designs are the key to the successful enhancement of learning. Clearly course designs have been transferred from traditional instruction to the DE environment. Standard lecture transmission has become the major instruction design; but, it is doubtful that the lecture mode works well in computer based DE environments (Tu & Corry, 2001).

It is important that course design must be tailored to the cultural mores of local learners. Many institutions have failed to consider the cultures of the learners in instructional design (McIsaac, 1993). Foreign DE models should be referenced but the course design must reflect the Taiwanese culture and the learning styles of Taiwanese students.

Adult instruction design should be taken into account. Most adult learners perceive their learning process as more self-directive; experiential learning techniques have more meaning; learning should be able to apply to practice; and learning should lead to increased competencies (Knowles, 1976). It is a challenge to integrate adult instruction design into current DE instruction because of the educational foundations of school systems and the passive learning of the culture. DE may exert limitations on independence, critical thinking, and intellectual inquiry. Therefore, there is need for students to be trained to be independent and utilize critical thinking skills that will benefit them at their workplace and in their lifelong learning experiences.

Effective evaluations will provide students feedback and serve functions of directing their learning experiences. Current evaluations adopt traditional test styles, such as true and false, multiple choice, essay, etc. It is recommend that various assessment strategies be applied to monitor student learning progress and should mix systematic, summative, and formative methods.

### **The needs of theoretical foundation**

DE in Taiwan has a short history; therefore, well-grounded and solid theoretical constructs are still evolving. Urgent need exists for more research to form a theoretical framework to project direction, to guide practice, and to serve as leadership.

### **Effective teacher training**

Distance teaching differs significantly from traditional teaching. In fact, many DE teachers have been applying their traditional teaching styles to distance environments, which result in many frustrations, ineffective teaching, and retardation of student learning. Therefore, prior to becoming involved in distance teaching DE teachers should receive training in distance instruction. "Ongoing" training is more effective than one-time training.

### **Curriculum integration**

Current DE graduates did not change their careers or use their degree to obtain a job. The purposes of DE are to provide various learning process to suit the needs of the students. Therefore, curriculum integration should be flexible to provide various programs, certificates, and trainings to assist students to achieve their individual lifelong learning goals.

### **Insufficient resources**

The government and their institutions do not adequately support distance teachers. The teacher and student ratio is fairly high (1: 21). In fact, distance teaching normally demands more of the teachers time and a greater amount of effort for course preparation, course delivery, student support, and course management etc. (Tu, 2000) because of the diversity of the students' ages, cultural backgrounds, learning experiences, and technology experiences. Therefore, continuing support for DE teachers is imperative.

### **Role of DE and Perception**

Although Taiwanese society has developed a room to face DE and the schools have developed rigorous adherence to high standards, most Taiwanese are still skeptical about the quality of this learning process, grumbling that it's not seemly to get a degree without going to school or by just watching TV. This misconception resulted from the fact that the government initiated DE as supplement to traditional education. Therefore, it has been seen as "alterative," "second best," and non-mainstream education. Particularly, it is wrongfully perceived that DE is for one who fails the college entrance examination to pursue his/her higher education and "Superior students go to traditional colleges." How society will perceive DE is a serious hurdle to cross in the process of development. It has been shown that DE students can learn as effectively as can students in traditional instruction (Hiltz, 1998). The authority should take the leadership to correct this misconception of DE.

### **Insufficient financial support**

There were insufficient funds dedicated to DE. Each year the government assigns US\$3,125 to \$9,375 for a traditional university student, while the expenditure for a DE student is US\$625. This differential in financial support limits distance students from obtaining a start-of-the-art quality instruction through distance learning technology when compared to students in traditional universities.

### **Conclusions**

Moving Taiwan towards a learning community is an ideal and ultimate goal. The technology-based learning serves a vital tool to enhance learning. Learning and knowledge are the goals students need assistance to attain. Content, hardware, and software do not equal knowledge. The utilization of various learning technologies will allow Taiwanese to select their ideal learning methods to achieve their lifelong learning goals and to reach the definitive goal: "life is learning; learning is life."

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## Infusing Wireless Technology into Teacher Education

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### Abstract

The brightest promise of technology in education is as a support for new, innovative, and creative forms of teaching and learning. The Centre for Educational Technology at Simon Fraser University has established a wireless network throughout the instructional areas in the Faculty of Education. This network is used in conjunction with a 'portable lab' of laptop computers and allows us to infuse technology into our work with the Professional Program (Pre-Service Teacher Education) in a variety of classroom settings. This infrastructure currently satisfies many of our current and future instructional and technological needs while providing a rich venue for the project and further and continuing research and evaluation associated with it.

### Introduction/Background

Educational reform initiatives aimed at integrating technology into the curriculum are well at work in institutions of higher education such as Simon Fraser University. As more and more K-12 teachers are required to change their teaching methods and teaching styles to include technology, educators within teacher education programs are being asked to alter their methods and styles of preparing teachers, specifically to include teaching with technology (Edwards, Ahn and Mooney, 1998). To facilitate this change and to structure computer-based activities, many teacher preparation programs in Canada and the U.S. tend to use the International Society for Technology in Education (ISTE) Foundation standards, (ISTE, 1997a; ISTE, 1997b; ISTE, 1997c). However, while teacher education programs may have a short-range need to impart basic computing skills to their students, the real challenge is to teach and to reinforce these skills to pre-service teachers while simultaneously showing them how to integrate the technology into the range of curriculum they will be teaching.

Generally, educational researchers would place schools, colleges, and departments of education (SCDE's) along a continuum in terms of this goal for the integration of technology (eg. Beck and Wynn, 1997). However, comprehensive reports on the subject indicate that the use of technology is not central to teacher preparation and that most technology instruction concerns "teaching about technology" rather than "teaching with technology" across the curriculum (eg. U.S. Congress, Office of Technology Assessment, 1995). A more progressive view of the needs of SCDE's in the U.S. was posed by a report by the National Commission on Teaching & America's Future (1996) which posed the challenge: "Schools of education need to model how to teach for understanding in a multicultural context, how to continually assess and respond to student learning, and how to use new technologies in doing so" (p.77).

In Canada, Faculties of Education need also to pay greater attention to the goal of integrating information and communications technologies (ICTs) into Pre-service teacher education programs. A recent report by the Angus Reid group (Globe and Mail, 2000, September) stated that Canada is near the top of the class globally when it comes to offering Internet access to its students. The report relates that 74 per cent of this country's students had Internet access at school, while 71 per cent had access to it at home (U.S. students were more likely to report Internet use available at home than at school). Further, the Industry Canada project, SchoolNet, claimed last year to have made Canada the first country in the world to connect all its public schools to the Internet. This public infrastructure then forms an important part of the teaching /learning context in public schools. At the very least, this argues the point that pre-service teachers need adequate preparation in its use.

The use of wireless networks and ICT has also the potential to transform learning and teaching. In this, the underlying principles of learning and cognition are the same as for all media and learning environments. Like other technologies, the Internet brings into being the ideas of its early innovators--in this case, ideas about hypertext and universal sharing of documents and texts. The Web can also be a vehicle for realizing the vision of educational thinkers like Dewey, Piaget, and Vygotsky who long ago advocated a constructivist or meaning-centered approach to learning and teaching (Wilson & Lowry, 2000, May). Constructivism, which stands in contrast to mechanical

conceptions of thinking and action, emphasizes the learner's role in constructing meaning—as opposed to simple transmission from teacher to student (Duffy & Cunningham, 1996). Learners do more than process information—they build an understanding through interaction with their environments (and the technology infused into these environments).

### **Infusing ICT into Curriculum**

In the context of pre-service teacher education, a number of early attempts have been made to describe the effective and pedagogically meaningful integration of ICT into the curriculum. Omoregie & Coleman (1998) designed a study which investigated the degree to which technology infusion played a significant role in the development of quality instructional materials by pre-service teachers and influenced their academic performance. Their study reported that their integration of ICT into the curriculum enhanced the interactions between students and preservice teachers while also increasing motivation, computing skills and academic performance in pre-service teachers. In addition, the researchers noted that the infusion of ICT encouraged rapid feedback between university faculty and pre-service teachers and that this increased student interaction using electronic mail enhanced their writing skills.

In another study (Perschitte, 1998), case studies were conducted to document and analyze factors (positive and negative) associated with the integrated use of educational technologies within SCDEs and further to develop rich descriptions of best practices use and integration to serve as models for preservice teacher program revision. Among its intentions, the study aimed to document (in a qualitative sense) what characteristics of pre-service teacher faculty, students, curricula, and programs would currently be considered examples of "best practice" in the use and integration of educational technologies for the preparation of teachers. Examples described in the report included the development of problem based learning (PBL) workshops, and a range of student designed 'electronic portfolios'. The study further inferred how the use and integration of educational technologies influences the planning for, and maintenance of existing technology infrastructures and of curriculum frameworks within pre-service teacher education.

Edwards, Ahn and Mooney, (1998) discuss one such problem-based approach which they term 'scenario-based computing'. They relate that these activities incorporate the day-to-day work situations encountered by in-service teachers with the possibilities of effective computer use and so provide pre-service teachers with an opportunity to focus on both the (professional) management and instructional duties faced by in-service teachers and technical integration issues within the classroom. The authors relate that scenario based activities also force students to think about each task in relation to tasks or situations that they might actually face sometime in the future. The use of scenarios in ICT instruction may facilitate students to think about and discuss computer use relative to (a) what needs to be done, (b) why the computer becomes the medium of choice for a specific scenario, and (c) exactly how the computer will be used.

Another approach to ICT infusion is related by Doty and Hillman (1998) who describe their Teacher Technology Portfolio program as one integrating instruction on technology with 'modeling of instruction' with technology throughout the course work in each of the teacher training program. Pre-service teachers begin their portfolio work in their introductory courses with opportunities in later methods courses to build competence; investigate curriculum and technology connections; and to develop and implement activities integrating technology. The portfolios are then finalized during the professional, student teaching semester. Portfolio requirements described included the development of a reflective statement regarding technology and education, the development and implementation of lesson and unit plans (with electronic artifacts), and a documentation of mastery of basic and advanced competencies with a variety of instructional technologies.

Jackson (1998) describes another portfolio approach taken. In this project, pre-service teachers developed computer portfolios as part of their professional program. Included in these portfolios were such items as text casts of philosophical beliefs, voice casts of effective teaching strategies, and digitized videos of actual teaching performance. The author states that portfolios allowed pre-service teachers an opportunity to both self reflect and assess their recent student teaching experiences while providing them with a greater understanding of how technology can be implemented into their future classrooms. Jackson states that the process of pre-service teachers developing their own computer portfolio had many positive outcomes. First, these pre-service teachers benefited by reflecting upon their student teaching experience as they compiled their own effective teaching characteristics. Second, the end product became a very valuable instrument in the student's job search. Third, the opportunity to author their own computer portfolio provided students with and increased technical capacity to infuse technology later in their own classrooms.

Finally, in an approach to teacher education that would be viewed as consistent with the student centred and constructivist models described, Topper (1998) relates a strategy which uses Technology coaches (or mentors) hired to support students learning to use technology and to assess their technological proficiency. The success of this work (and the mentoring model applied) was credited in helping future teachers develop the necessary expertise, dispositions, and attitudes to support their own generative learning around and with technology, and learn to use technology appropriately to serve some useful pedagogical end. With this project, the Centre for Educational Technology applies a similar model in infusing technology into pre-service education through the use of our wireless network and portable lab, the provision of a project facilitator and the development of workshops aimed at generating student designed (web based) instructional resources and the connection of these to their development as professionals through the progressive design of electronic or 'virtual' portfolios.

### **Project Methodology**

The development of knowledge and skills related to the use of information and communications technologies (ICT) is an important goal for any teacher education program. In this, it is important to consider technology learning objectives as an integrated part of the development of teacher-professionals and not a separate requirement. In practice, this means subordinating technology-learning to the overarching professional nature of the pre-service curriculum, our intentions with this project are: to explore the possibilities for technology to enhance learning in the pre-service curriculum during on-campus experiences; to consider ways to utilize technology in our approach to subject-specific and integrated curriculum studies in the practicum settings; and to enable an understanding of technology as one of the many aspects of teaching and learning that collectively contribute to effective pedagogy. Further, social, gender and cultural issues that surround the use and possibilities of technology will be addressed and attended to within on-campus and school-based experiences.

This project is also sensitive to the reality that many pre-service teachers have little familiarity with technology. Our primary aim is to provide supportive learning situations that will facilitate both their comfort level and their expertise. There are two components to our current project: construction of 'virtual portfolios' throughout the program; and the design and implementation of a technology project during their practicum experiences. The requirements for the virtual portfolio accommodate the potential differences in competency, and on-campus experiences will include specific instruction in the use of technology which will support pre-service teachers' abilities to utilize technology in effective and pedagogically meaningful ways. In addition, pre-service teachers will have opportunities to collaboratively participate in technology-supported inquiries through the self-initiated projects which will also support their technology learning and provide a meaningful context for technology-based inquiry within their practicum experiences.

Perhaps one of the greatest strengths of embedding technology within a pre-service module is that there is no presumption of expertise. In other words, learning about pedagogy, and learning about the possibilities of technology as a supportive pedagogical tool, are embedded within the broader goals of Professional programs. The intent with both is to nurture and encourage pre-service teachers to construct, reflect upon and practice their beliefs about teaching and learning, always attending foremost to the needs and abilities of the children who become their students. Beyond the specific requirements of technology-learning and learning about the unique aspects of middle school theory and practice, our ultimate goal is to create a meaningful, supportive and enabling learning environment for our pre-service teachers that will optimally be a model for their own practice.

Our specific goals related to the development of an ICT strand within pre-service teacher education programs are therefore threefold:

- 1) To infuse technology into the entire teacher education program. Throughout their teacher education experience, students should learn about, learn with, and learn to incorporate technology into their own teaching.
- 2) To introduce technology in context. Teaching pre-service students basic computer literacy is not enough. Pre-service students should learn about the many uses of technology because they are integrated into coursework and field experiences.
- 3) To allow students to experience innovative technology-supported learning environments in their pre-service program. Technology has the potential to transform learning.

The brightest promise of technology in education is as a support for new, innovative, and creative forms of teaching and learning. The Centre for Educational Technology at Simon Fraser University has established a wireless network throughout the instructional areas in the Faculty of Education. This network is used in conjunction with a

'portable lab' of laptop computers and allows us to infuse technology into our work with the Professional Program (Pre-Service Teacher Education) in a variety of classroom settings. This infrastructure currently satisfies many of our current and future instructional and technological needs while providing a rich venue for the project and further and continuing research and evaluation associated with it.

The Wireless LAN technology was introduced gradually over the fall semester (September-December 2000) by developing a mobile computing lab consisting of 16 IBook (Apple Macintosh) computers organized on a portable cart. In addition we began offering 'Wireless Workshops' to Pre-service teacher education modules and working extensively with the Middle School - Learning Community module in Jan.2001. These workshops demonstrate the utility of the wireless network technology (and mobile lab) while also introducing potential applications for its use in teacher education and classroom instruction. The workshops are followed up with consultation and collaboration with faculty-associates in the teacher education program to ensure their continued use and connection with the instructional goals of the program. These connections are part of an on-going research and evaluation project that began in January 2001.

### **Conclusion**

Evaluation of our current work is continuing as we monitor the efficacy of our approach and the suitability of the learning environment we have provided for our students. Observation, interview and classroom learning environment surveys assist us to document and compile case studies on a variety of pre-service projects as they relate to teaching experiences designed by our developing teachers. Finally, in documenting the development and implementation of the wireless network in Teacher education we will continue to look for a number of different types of information related to its efficacy. For example, What technical and pedagogical limitations are imposed or removed by the use of ICT in teacher education? How do these differ from those experienced in other other ICT settings? Further, what are students' perceptions of their learning environment when using ICT in this way? Finally, are there qualitative differences in the nature of their technology-learning in the wireless setting? (i.e. Can enhanced connections between ICT and professional practice be described?)

In order to implement and evaluate this process, we have facilitate opportunities for students to critically examine their teaching practices and the assumptions they make about the nature of learning, teaching, and the role of technology - These are the learning goals of the electronic portfolios they create. Further, in building collaborative relationships, and in respecting the students' knowledge and expertise that they bring to these interactions, project staff support student efforts to construct their own practices of teaching with and document this through the design and implementation of web-based pre-service projects implemented during their practica. We believe that these approaches are consistent with the socio-constructivist views of learning we hold in the Middle School Module of Professional Programs and in the Centre for Educational Technology at Simon Fraser University.

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# COLEGA: A Collaborative Learning Environment based on Individual and Group Memory Building

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**Abstract:** Collaborative learning systems offer common virtual spaces where different users (i.e. teachers, students, school directors, parents, researchers, and experts) can interact. Participants can share their pedagogical, technical and administrative knowledge. CONEXIONES project, a research group that has been enhancing the learning process in Colombian schools through the use of new technologies, has developed COLEGA, a collaborative and learning tool to support knowledge evolution processes within learning communities.

This paper presents COLEGA, a collaborative and learning tool that integrates retrieval document algorithms based on keyphrases, synchronous and asynchronous communication tools, and support for evolving individual and group memory. Results of a usability study are also presented in this paper.

## Introduction

CONEXIONES project is part of the R+D Group in Computers in Education at EAFIT University - Colombia. CONEXIONES aims to improve Colombian education by developing and implementing new learning environments in real schools and community centers (Zea et al. 2000). More than one hundred schools (urban and rural, private and public) from five provinces of Colombia form part of CONEXIONES. There are strong cultural differences and social-economical levels among schools. Every month approximately 12.000 users interact in a virtual space. Users are students, teachers, parents, researchers, educational agents, and family members of the community centers.

COLEGA facilitates communication among users. Researchers and technical staff need to be in constant communication with teachers, students and family members within CONEXIONES. COLEGA provides users with synchronous and asynchronous communication tools where they will be able to solve their problems, share ideas, and express their pedagogical and technical doubts about CONEXIONES. COLEGA has been proposed as a new alternative to support communities within CONEXIONES.

Different groups can create their own learning spaces. For example, teachers in COLEGA use a learning space to discuss about topics related to collaborative projects. A teacher can create a learning space to interact with their students and an invited expert. Family members can be also involved on different groups in order to share their ideas with students and teachers. Students and teachers from several schools working on similar collaborative projects are able to share ideas and knowledge. Students from low-income and rural areas have the opportunity to interact with students, teachers, researchers, and experts from different regions and countries. Thus, COLEGA is instrumental in integrating educational communities.

## Related Work

Learning communities have been supported using a variety of technologies. From simple electronic mail, multi-user environments (MUDs and MOOs) to collaborative virtual spaces. CSILE - Computer Supported Intentional Learning (Scardamalia and Bereiter 1991 1996 1999), for example, uses new technologies to support decentralized forms of discourse, and knowledge building within a discipline. CSILE is an asynchronous discourse tool that supports knowledge building providing thinking-type labels, scaffolding of notes, and different views of notes. CSILE has demonstrated how such technology produces positive

effects in learning. CaMILE (Guzdial et al. 1995) offers a collaborative environment in which participants can share their ideas through the use of notes. Students in CaMILE can classify their interactions and change accessibility privileges to their notes. The IHMC Concept Mapping Software - CMaps (Cañas et al. 2001) empowers users to construct, navigate, share, and criticize knowledge models represented as Concept Maps. The toolkit allows the users to build, and collaborate during the construction of concept maps, as well as, share and navigate through others' models distributed on servers throughout Internet. COLEGA distinguishes from existing software by its particular use of keyphrases-based technology and participants' annotations to categorize and organize documents and interactions, that makes it possible to manipulate individual and group memories in benefit of the participants.

## COLEGA

“In classrooms that adopt the collaborative knowledge building approach, the basic job to be done shifts from learning to the construction of collective knowledge. The nature of the work is essentially the same as that of a professional research group, with the students being the principal doers of the work. Thus, in the ideal case, there is a complete shift from students as clients to students as participants in a learning organization.” (Scardamalia and Bereiter 1999).

COLEGA supports users working in a learning activity by offering collaborative learning spaces in which they can learn from each other, solve their problems, learn about collaboration, and learn the appropriate use of this technology in their own context.

Fig. 1 presents a general view of COLEGA. Users can interact with synchronous and asynchronous communication tools to create documents and/or interact with other users based on previous documents. Users classify each interaction as a document, an idea, an alert, an attention, a question, an agreement, or a disagreement. Automatic key-phrase techniques are used classify each document with in a list of domain categories. This facilitates organization of documents with in individual and group memories.

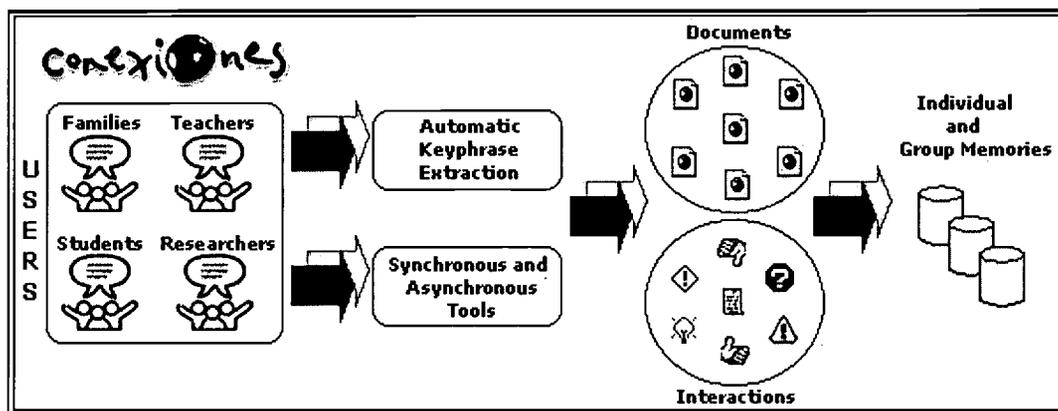
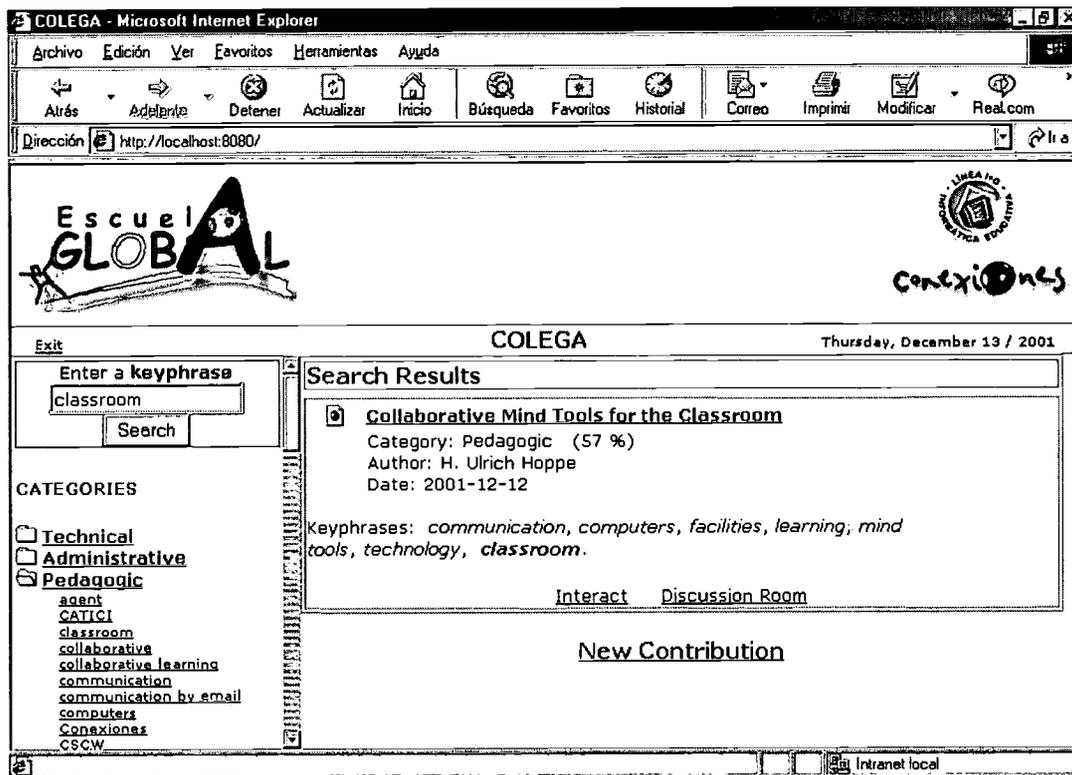


Figure 1: COLEGA Architecture

Participants can maintain their own knowledge space (individual memory) and share it later with their group. Students can decide with whom they want to share their questions and new ideas. Teachers can monitor individual and group memories to be able to guide students with their learning processes. Teachers can generate a list of topics of interest and use this information in their class. In that sense, COLEGA becomes an assessment tool for teachers. Furthermore, students and teachers in COLEGA can make the group memory available for other users to start a discussion based on an existing document or interaction. These users will create their own individual and group memories by including their own questions, ideas, or answers. As individual and group memories evolve, CONEXIONES' project memory evolves. Participants have three different ways to interact within COLEGA: by participating based on an existing document, by participating based on a previous interaction, or by adding a completely new document or interaction. In the first two cases, participants can use synchronous or asynchronous communication tools to add their interaction or document. When participants are not satisfied with the search results or there are not documents or interactions related to a particular keyphrase, users can start their own discussion.

COLEGA will automatically extract keyphrases from the new document and will make it available for others to participate. See Fig 2.



**Figure 2:** Interacting with COLEGA. Participants can use keyphrases or choose a topic from list of categories to retrieve information from available group and individual memories. Once the participant has found an interesting topic, he/she can use it to start a new discussion.

*Asynchronous and synchronous communication tools* allow users to interact with others in a variety of settings. Participants can use an initial document to work with and generate a final document with the contributions of the group. This process can be done on-line during a face to face meeting (synchronous tools) or it can be based on messages posted by the participants in a group memory (asynchronous tools).

Fig 3. shows a screenshot of the asynchronous communication tool in COLEGA. the user can select the user(s) to which the interaction is for, specify to whom a copy should be sent, classify the interaction according to one of the types COLEGA offer, type or import the document/interaction content, and send it. If the user desires to get help about how to classify the interaction, there is a help option available.

A group of participants can witness how their 'group memory' evolves through their interactions. New users can inspect group memories to learn about different topics. In fact, new participants can select an existing document to start a conversation with his/her own group. COLEGA provides methods to create and maintain knowledge spaces.

Moreover, several search facilities have been implemented using *automatic keyphrase extraction techniques* (Turney, 2000) to automatically extract keyphrases and classify information into categories previously generated based on existing documents. Using automatic extraction of keyphrases, documents can be classified into meaningful categories that will make simple searching processes. This in conjunction with participants' classification of their interactions within COLEGA makes individual and group memories easy to be accessed. COLEGA supports keyphrase based queries, which opens up existing documents to participants interested in a particular topic.

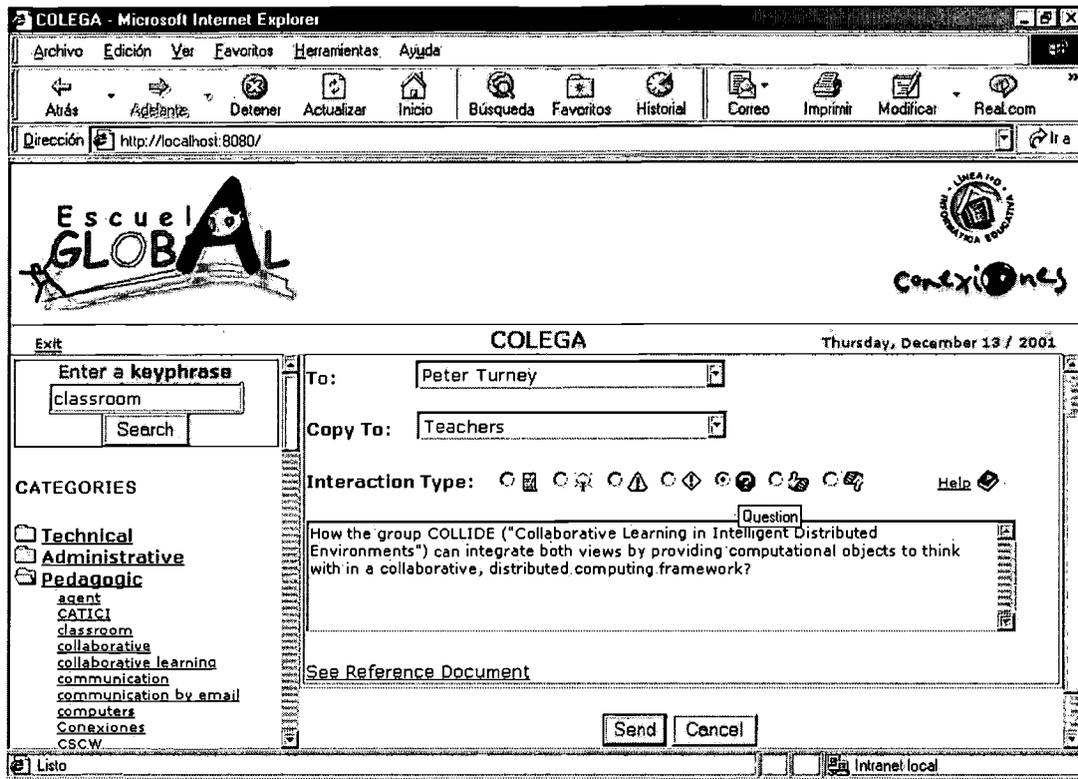


Figure 3: Asynchronous Communication Tool.

## Usability Study

In this study, teachers, students and researchers had the opportunity to use COLEGA to solve some common tasks, such as: searching individual and group memories using keyphrases, searching by using categories from a proposed tree of initial categories, reading existing documents and generating new interactions using asynchronous communication tools mainly. Initial documents were consistent with real CONEXIONES messages (i.e. emails, teachers' and students' reports, and papers and technical documents). Participants solved a final questionnaire and observers were taking note of their reactions towards COLEGA. Each task was carefully designed taking into consideration the participant's language and probable topics according to the type of participants (i.e. student, teacher, researcher, etc.). Some of the initial results are as follows:

- ✓ Teachers considered COLEGA to be a helpful tool in their teaching both as a learning and as an assessment tool. Teachers were able to use keyphrase based searching facilities to monitor students' work and to find information about their topics of interest. Teachers liked the idea of been able to keep in touch with researchers, teachers, and students from different places.
 

*"COLEGA is an interesting pedagogical tool because I can keep in touch with other users of CONEXIONES. Besides, it is possible to give your opinions and engage in the construction of knowledge. it provides a great opportunity to generate knowledge and increase the one we already have"* Teacher comment.

*"COLEGA provides a searching and interactive method to helps us to solve doubts with students, partners and experts."* School director opinion.

*"I think COLEGA is easy to use. I can find answers to the questions I have. I can also ask people who know about my questions."* Student comment.
- ✓ The Discussion Room – synchronous tool-generated a lot of interest. Participants considered that it will give them another way of interacting and building knowledge collaboratively.
 

*"I think is a great tool that will give a lot of support to the CONEXIONES Project. It will allow us to have more contact with teachers."* Researcher comment.

- ✓ Teachers and students considered COLEGA as an innovative tool, that will increase their confidence in new technologies. COLEGA reduces their fear to computers and encourages interaction among participants.
- ✓ Participants felt that the instructions were clear and enough to understand the way they were supposed to interact with COLEGA.

*"This system (COLEGA) seems to be useful for CONEXIONES' schools. It is a way to share experiences and to search for information related to different topics. It presents an attractive and an easy way to handle information. It motivates the members of CONEXIONES and increases their ability to share experiences."* Teacher comment.

According to the initial results and the comments by participants, COLEGA was accepted and considered as a useful tool that supports their learning activities. COLEGA combines collaborative learning tools, group and individual memory, human-computer interaction and document retrieval techniques.

COLEGA uses of keyphrase based technology and participants' annotations to facilitate access to individual and group memories. Learning communities can benefit by inspecting and interacting with information maintained by COLEGA.

## Conclusions

COLEGA is instrumental in providing a collaborative solution for managing group and individual memories. It promotes the generation of learning communities and learning spaces according to current participants' interests. This collaborative and learning tool aims to support participants of CONEXIONES with learning about a particular topic. In addition, participants can learn about group interaction, leadership, and collaboration while using the system.

COLEGA breaks geographic barriers in order to support modern learning communities. COLEGA was accepted by members of CONEXIONES who understood their potential and advantages to support learning in different settings. Future work includes a formal evaluation of the synchronous discussion room and integration of new tools to handle conceptual maps and learner models such as CMaps (Cañas et al. 2001) and ViSMod (Zapata-Rivera & Greer 2000).

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