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From the editor ..

Welcome to the July 2000 issue of *Learning Technology*. The newsletter is aimed to provide not only the report of various activities which are undertaken by IEEE Learning Technology Task Force (LTTF) but also document the latest happening in the world of advanced learning technologies.

The first event of LTTF - the IEEE International Workshop on Advanced Learning Technologies (http://lttf.ieee.org/iwalt2000/) is being held in New Zealand. You all are most welcome to participate. This

event is expected to initiate the series of such conferences. The next one is being planned at Madison, USA in August 2001. More details will follow in next issue of the newsletter.

I strongly encourage you to browse through LTTF website at http://lttf.ieee.org/ and take active part in various activities. To keep yourself aware with the happenings, please subscribe to LTTF participants list by sending an email to majordomo@majordomo.ieee.org with the following in the body of the message (no subject needed):

subscribe LTTF *email_address*

(Please replace 'email_address' with your actual email address.)

Besides, I invite you to contribute your own work in progress, project reports, case studies, and events announcements in this newsletter. For more details, please refer author guidelines at http://lttf.ieee.org/learn_tech/authors.html.

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International Workshop on Advanced Learning Technologies (IWALT 2000) (Call For Participation)

4-6 December 2000
Palmerston North, New Zealand
http://lttf.ieee.org/iwalt2000/

Sponsored by

IEEE Learning Technology Task Force
IEEE Computer Society (approval pending)

Supported by

Microsoft Research
IEEE Learning Technology Standard Committee
Distance Education Association of New Zealand

Background

The International Workshop on Advanced Learning Technologies (IWALT 2000) will bring together researchers academics and industry practitioners who are involved or interested in the design and development of advanced and emerging learning technologies. Understanding of the challenges faced in

providing technology tools to support learning process and ease the creation of instruction material will help building a direction for further research and implementation work.

Topics of Interest

The focus of the workshop is on the design and development issues of advanced learning technologies. The topics of interest for the workshop include but are not limited to:

- Architecture of learning technology systems
- Advanced uses of multimedia and hypermedia
- Integrated learning environments
- Application of artificial intelligence tools in learning technology
- Application of metadata
- Agents technology
- Practical uses of authoring tools
- Virtual reality
- Teaching/learning strategies
- Collaborative learning/groupware
- Adaptive and intelligent applications
- Internet based systems
- Application of instructional design theories
- Evaluation of learning technology systems

The workshop will focus on where the research in advance learning technology is heading and what are the implementation challenges in the real-world situations.

Important Deadlines

1 August 2000	Author registration
4 October 2000	General advance registration
4-6 December 2000	Conference dates

IWALT 2000 Committee Members

General Chair
Chris Jesshope, Massey University, New Zealand

Program Chair
Kinshuk, Massey University, New Zealand

Panel Chair
Toshio Okamoto, University of Electronics and Communications, Tokyo, Japan

Program Committee
Alfred Bork, University of California, USA
Rosa Maria Bottino, Consiglio Nazionale delle Ricerche, Genova, Italy
Radu Cotet, University of Namur, Belgium
Roger Hartley, University of Leeds, United Kingdom

Andrew Higgins, Distance Education Association of New Zealand
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Judy Kay, University of Sydney, Australia
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Ashok Patel, De Montfort University, Leicester, United Kingdom
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Alex Shafarenko, University of Surrey, United Kingdom
Katherine Sinitsa, Intl Res. and Trng Ctr of Info. Tech. and Systems, Kiev, Ukraine
Andrew Skrynnyk-Chambers, Massey University, Palmerston North, New Zealand
Terry Stewart, Massey University, Palmerston North, New Zealand
Daniel D. Suthers, University of Hawaii, USA
Philip Uys, Massey University, Palmerston North, New Zealand

Proceedings

IWALT 2000 proceedings are published by IEEE Computer Society Press and will be distributed during the workshop. Extended versions of some of the accepted papers will be invited for an special issue of Educational Technology & Society (ISSN 1436-4522) journal.

Exhibits

The workshop will provide a unique opportunity for software vendors, courseware developers, and commercial research projects to display products and technological solutions in the different areas of learning technologies. To discuss the options, please contact: General Chair: Chris Jesshope (C.R.Jesshope@Massey.ac.nz)

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Physical Science Survey I: Analysis of an Online Lab-Based Science Course

Abstract

Mississippi Gulf Coast Community College began providing a lab-based physical science survey course over the internet for non- science majors in the spring semester of 2000. The course development took place over the course of the previous semester, and was able to overcome a variety of hurdles including the justification of performing experiments outside of the traditional laboratory setting. Analysis of the course after completion of the first semester offering indicates that a successful course was created.

Course Justification

The first round of justification of any online course must first be done with the developers and the instructors and then spread to the administration and educational community. Four major points were made in justifying the physical science survey course: 1) consider the target audience, 2) consider whether or not student needs are being met in the traditional lab, 3) subject matter integrity, and 4) course market.

The target audience for physical science survey consists of non-science majors who have little to no experience in science courses and who will only take one science course. A primary hurdle with this audience is motivating the students to perform in the course and hence leave with a positive attitude towards the subject matter. The online method of instruction offers an alternative means for students to take the course that lessens the blow of "having to take the course".

Whether or not the traditional lab is meeting the student needs is an old question. Technically physical science survey is defined to be a descriptive study of ones environment. Therefore, performing experiments in the confines of a four-walled laboratory is effectively removing one from their environment. The "do at home" labs are more effective in removing the abstractness of the experiments performed, while ensuring that students acquire the experimental skills and techniques that are desired in a laboratory setting.

Most instructors will readily say that they are protective of what their students learn, and want to ensure that they are exposed to only reliable information on any given topic. With the vast amounts of information readily available online, this task is impossible. Keeping this in mind, the developers realized that to ensure the integrity of the subject material to which a student is exposed that they needed to be creating themselves rather than relying on outside information.

There is a market for online courses in all areas. In the case of the community college, tradition dictates that programs reach into the community and allow everyone the opportunity to learn. Online courses expand this to a variety of "travel inhibited" students. Examples include parents with daycare responsibilities, military personal on deployment, people with job restrictions, and many others. Additionally many large internet-oriented companies are realizing that even though the e-commerce industry is slowing, that the education and government markets for internet usage remain largely untapped.

Course Development/Implementation

Development of the course comprised creating text reading assignments, lectures, laboratory experiments, and testing. The course was broken into four units, which cover all of the state mandated topics for a physical science survey course. The units are mechanics, energy, contemporary physics, and astronomy. Nine lectures, three labs, one test and multiple reading assignments were created for each unit. To develop lectures and lab materials, all work was done in html and then uploaded to a server. This allows great versatility in using graphics, simulations, immediate feed back review questions, and in accessibility. It also eliminates the problems associated with file uploads, downloads, and software compatibility. While the majority of the material was created by the two-instructor development team, there was also a group of students who played a vital development role. These students created lectures, graphics, test questions, edited instructor lectures and performed the experiments to check for errors. Some educators have been critical of the use of a student team for development, but their input is indeed invaluable and saves the instructor large amounts of time.

Implementation of the course uses the Courseinfo software package from Blackboard Inc. This platform was chosen for statewide application in the community college system. The software package maintains all of the standard features of such software including testing abilities, chat rooms, grade books, etc. In terms of

logistics, the most important part of course implementation is maintaining a rigid course calendar. For our course, this calendar lays out a projected course of study that the student is expected to maintain. The only real time constraint on the calendar is the testing dates. It is designed to encourage students to keep pace with the course while not limiting those who proceed forward at their own pace and complete the material early. Finally, implementation during the first term a course is taught will meet with problems in the materials and technical problems. A well-rounded team who is prepared to make changes to the course in real time is the best tool for solving the problems that arise.

Course Laboratories

Physical science survey at our community college consists of 12 lab experiments (three per unit). None of these experiments is computer-based experiments or simulations that require the student to sit in front of the computer screen and perform a lab. The student spends time in front of their PC in the course working through lectures, working review questions, taking quizzes and tests, and communicating with the instructor. One of the primary lab goals is to use the experiments to shift student focus from the PC to the course material. Likewise, another goal is to literally bring "home" the concepts. As mentioned earlier, placing the student in a four walled room effectively removes them form the environment that we are studying. Doing the activities at home puts the concepts into real world, memorable settings.

The laboratory at home away from the PC also helps to alleviate two concerns surrounding online courses. Lack of group participation in online courses is an echoed concern. Frequently spouses, children, parents, in-laws, and others become engrossed in the experiments with the student. Secondly, everyone is concerned about who is actually doing a students work in an online class. Utilizing questions that arise from experimental data and observations on tests and in other areas throughout the course helps to ensure that the same person is doing the experiments and the tests. Once a lab is completed, students either email in a report on their observations and data or are given a quiz depending on the experiment.

Course Analysis

Without using complex statistical analysis, the course developers have deemed the course a success. This conclusion is based on reviewing three indicators associated with the course: 1) student comments, 2) review of the course usage statistics provided by the implementation software package, and 3) comparison of withdrawal rates, and course grades with lecture based classes over a five year period.

Student comments are never always positive. However, with the online course if one numerically compares positive to negative comments, the positive comments prevail. Most encouraging of the positive comments are those that indicate the student has actually learned from the course concepts. One of the developers favorites is:

"You never think what you learn in class will come back to you……
……..thanks to my physical science class I didn't kill my fish".

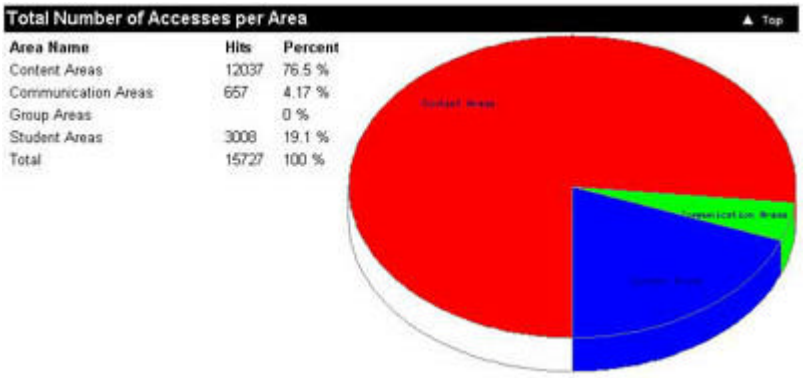
These types of comments reinforce the need to bring concepts more into the students own environment. As far as the negative comments went, they were the same as those for lecture-based classes. Students

complained about the mathematics in the material, the amount of material covered, the length of the tests etc. Ironically, there were very few negative comments that centered on technology problems with computers, software, and internet service providers.

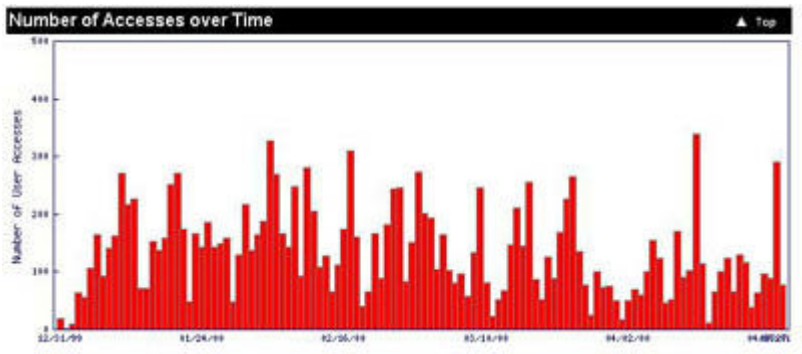
The course implementation software package does an adequate job of tracking usage statistics for each individual student as well as the class as a whole. From this data, instructors can monitor which areas of the course are being most frequently visited, etc. As can be seen from the numbers and chart below, the developers are encouraged by the fact that the content areas of the site are the most often visited, and that the average hits per student per week is adequate to cover course material.

Total # of Course Hits: 15,727 Average # Hits Per Week: 983

Average # Hits Per User: 357 Average # Hits Per User Per Week: 22

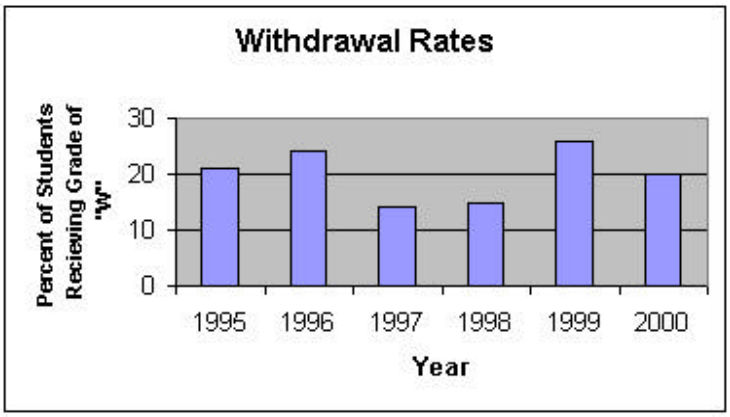


Also encouraging is that the distribution of number of accesses over time maintains about the same pattern over the entire 16 weeks indicating that each of the four units received approximately the same amount of student attention. The slight decrease in activity as the course progresses is attributed to the students becoming more efficient at maneuvering the course site and thus having to access the site less.

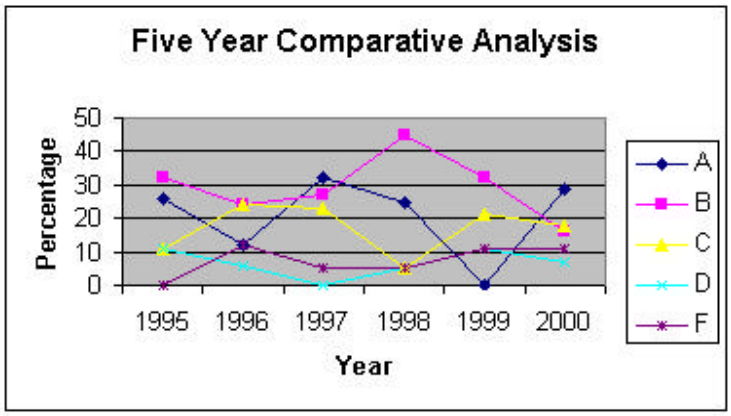


Proceeding to the "tell all" numbers, the charts shown indicate the relationship between withdrawal rates and final course grades for the online course versus the lecture-based course for the previous five years. The most encouraging statistic is the course withdrawal rate. Compared to the lecture-based classes the year 2000 online class falls above two classes, and actually below three of the classes. To the developers, this

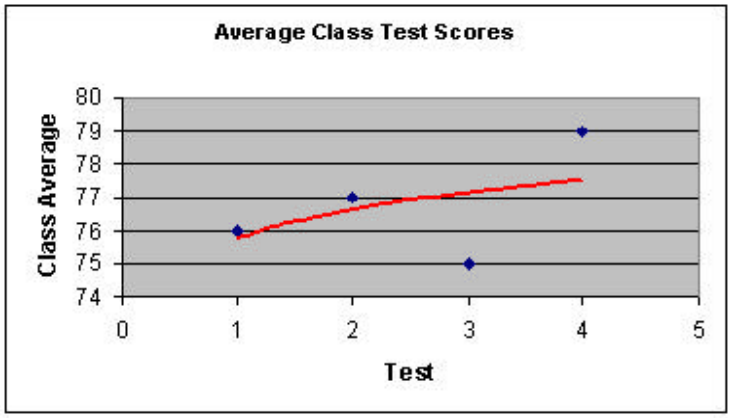
indicates that their fear of having students withdraw because of the technical aspects of the course such as using a computer, internet service providers, and software problems, was unfounded.



From the five-year comparative analysis of letter grade distributions, it is easily discerned that the year 2000 online class follows the trend of the previous years. The only slight difference that is appreciable is a decrease in the number of assigned B's over past years. The other letter grades all follow approximately the same year trend, with the overall six-year trend approaching a grade of C. Here again the developers are encouraged that the class performance is in agreement with the lecture-based course. The only possible disappointment is that the online class did not appreciably outperform the lecture-based courses.



A final question asked was did the online class, as a whole, improve as the semester progressed. Looking at the class averages for each test, and a corresponding trend line, the answer is yes. Although slight, the trend was one of improvement. This data readily indicates the unit of material within the course that posed the most difficulty for students, contemporary (modern) physics. Course developers will be looking into this section for improvements. It is also interesting that the section on astronomy received the best class average. Developmentally, large amounts of effort were put into securing outside internet sources for each topic. Typically, the most and best sources referred to the astronomy section.



Conclusions

From the data analysis, and the experience of developing and teaching physical science survey, the developers have deemed the course a success. Although the online class performance does not exceed the lecture-based class performance, neither does it fall short. With the added advantage of increased resources, and more importantly the time flexibility, the online physical science class has proven an excellent alternative to the traditional lab-based science course for a number of students. The instructional methodology for the course can best be described as facilitation. In fact, the method has proven so effective in motivating students that hybrid (lecture/online) classes are being considered for the department. The developers of physical science survey hope to continue their efforts with a second semester course, and additional courses in the science survey arena.

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Using Real-Time Chat to Increase Student Interaction

Abstract

What happens when students enrolled in web-enhanced graduate courses need to interact synchronously? Typically, when the course meets off-campus they must rely on place and time dependent real-time meetings.

However, this can detract from the overall attraction of web-enhanced classes that are held both on-campus and off-campus. This article addresses the use of real-time chat as a viable alternative to face-to-face off-campus meetings.

Introduction

Graduate level courses that incorporate both traditional face-to-face synchronous instruction and asynchronous off-campus independent student work enables the student to better use his/her time in the preparation of course deliverables. Working asynchronously and being able to send class assignments as e-mail attachments is a distinct advantage in student time management. This methodology also works well for group assignments where each group member works on a portion of the assignment. Documents can be e-mailed to group members, reviewed by members, and forwarded to the sender(s) with noted modifications.

However, one of the concerns of this or other forms of distance education is a perceived restriction on student-to-student interactivity (Simonson, 1997). In this instance, student-to-student interactivity for collaborative work can be limited to asynchronous methods such as e-mail or require on-campus face-to-face meetings with the group members. This can be extremely difficult especially in the case of adult graduate students with varied work, home, and school schedules. Outside of the normally scheduled enrolled classes, students typically are unable to meet as a whole.

What, then, can be done to facilitate collaborative work assignments while at the same time offering cost effective solutions? Can technology aid these types of class assignments with a technology transparent solution? Has the increasing use of problem based learning, group projects, and collaborative learning placed excessive demands on distance learning instructional methods?

Learner Experience

In a graduate level Instructional Design seminar, students were divided into five separate groups with each group consisting of between three to five members. Each group was assigned an instructional design project with a topic of their joint choosing. Completed projects included a PowerPoint presentation in addition to an APA document containing detailed and supporting research.

During the fifteen-week course, the students met as a class 12 times with three off-campus classes for the groups to meet independently outside of class in order to create and prepare their presentation and paper. Both independent research and collaborative work efforts were encouraged, with the actual work performed based on the students' assessment of the actual tasks required to successfully complete the class assignments.

The group, of which the authors were members, consisted of three students. During the progression of the course, it became increasingly apparent to this group that more frequent meetings to discuss planning and strategies were necessary for academic success. Because all three students had varied schedules (both work and class) and lived in three different geographic locations, real-time communication (i.e., telephone) would have incurred excessive long distance telephone charges, and therefore was considered cost prohibitive.

While e-mail provided a convenient method of transmitting documents (Moore & Kearsley, 1996) for review and for leaving messages related to the projects design, the need for a cost-effective synchronous communication between the group members became apparent. Based on this perceived need, the group considered employing real-time communication software beyond what technology was deployed in the course.

To accomplish this, it was first necessary to assess the group members' current Internet Service Provider (ISP), individual technology competence, and end-user hardware. Information gathered indicated that all three group members possessed a relative high level of technical competence and subscribed to Internet providers that were compatible with real-time communication software. However, significant differences in the group member's hardware and operating systems necessitated that the selected communications software be platform neutral. Based on this assessment, America On Line (AOL) Instant Messenger (IM) version 3.0 was selected.

After downloading the free application, each group member then installed and configured the software. E-mail was then used to inform the other group members of the users chosen screen name. At this point, each group member added the other two members to their "buddy list". As the software notified each user when the other group members were on-line, immediate feedback was available regarding the group member's on-line status.

Scheduled chat times were then assigned so those group members were on-line and prepared to discuss issues related to their project in real-time. When necessary, e-mail was used during or after the chat to provide deliverables to the other group members. The chat software also allowed the group members to use web browsers simultaneously during the real-time chat in the event that additional research was required. In essence, the group members were able to multi-task (e.g., web-browser research and e-mail) while simultaneously participating in the real-time chat.

Summary

Collaborative, group assignments, and problem-based learning are typical instructional methods used in graduate education. Adult learner characteristics support this methodology as vehicles for increasing the skills and knowledge of adult learners (Galbraith, 1998) and in the enabling of self-directed learning.

The use of these instructional techniques can cause scheduling problems when group members have varying schedules and/or are geographically diverse. In some instances, face-to face meetings outside the course's scheduled times and locations are required. While such asynchronous technologies as e-mail and/or web postings can facilitate group interaction, synchronous communications are often required.

Interactive chat-software facilitates synchronous interaction by providing group members a location independent method of interacting in real-time while simultaneously conducting on-line research. As the Internet was used as the enabling technology for real-time chat, additional costs (e.g., long distance telephone charges) were typically not incurred.

References

Galbraith, M. W. (1998). *Adult learning methods: a guide to effective instruction*, Malabar, FL: Krieger Publishing Company.

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Building a Web Site Administration Program at a Community College

Goals and Objectives

As a result of the ever-increasing popularity of the Internet, the job market for employees proficient in web site management skills has expanded dramatically. San Jose City College's (SJCC) two new programs, Web Site Administration and Web Application Solutions, offer classes designed to give students the necessary skills in administering a Web site and in creating applications for the Web to compete in a rapidly changing job market. The new Web Site Administration and Web Application Solutions programs SJCC (http://www.sjcc.cc.ca.us Select CIS from the drop-down list box for detailed information about these programs.) is implementing will serve this growing job market for web and networking professionals who are capable of developing, monitoring, and managing a corporate Web site.

Local government agencies and private industries enthusiastically supported the development and implementation of these programs. Agencies such as the Santa Clara County Social Services are now interested in hiring students enrolled in these programs to work as interns involved in writing programs to display database fields as web pages, for example. Many medium to small-size companies, such as Manx Web Solutions and Qarbon.com, are eager to hire students to develop Web-based applications. Large organizations such as Sun Microsystems and Oracle are working with SJCC to provide cooperative industry partnerships.

Program Description

San Jose City College's **Web Site Administration** degree program offers classes designed to give students the necessary skills in administering a Web site. This degree includes classes that cover both the programming and networking skills necessary to implement interactive, dynamic technologies supported on many corporate Web sites.

The **Web Application Solutions degree** program provides students with the skills necessary to design front-end applications for a Web site. Using their programming skills, students are expected to design and

create applications that search a web site, obtain interactive information from visitors to the site, implement push and pull technologies, client server interactions, and provide the benefits of having a dynamic, well-structured Web site.

Program Rationale and Purpose

The purpose of the SJCC Web degree programs is to provide students the skills necessary to achieve the following goals:

- Obtain jobs in a rapidly growing technology area
- Work as interns in industry while completing the program
- Pass industry-recognized professional certification programs (i.e., Microsoft, IWA, WOW, CompTIA i -Net+ exams)
- Transfer to 4-year institutions to further their education

This curriculum will not only prepare students for employment in industry but also in the academic area. Currently, several California colleges hire individuals to manage Web development in both the instructional and administrative areas. The instructional web master manages faculty and student web sites while the administrative web master works for Computing Services, the administrative division of the campus.

Community Resources

As the Web Site Administration program grows, the services of the Silicon Valley Workforce Initiative Network (WIN) program will be used in order to increase relationships with employers and opportunities for student internships and job placements. The WIN program, which maintains a database of potential employers, will track internships and job placements for purposes of program evaluation and modification.

Labor Market Trends

The Internet continues to increase in popularity driven by the rapid growth of several factors including:

- A healthy and competitive Internet access provider market
- Enhanced bandwidth becoming available to businesses and homes
- Development of inexpensive standardized tools for publishing on the Web

At the same time, more sophisticated software and technology, such as future generations of browser software, are developing. Because of these trends, colleges need to provide courses that offer students the skills necessary to support sophisticated enterprise-wide intranets, internets, and extranets. The need for Web masters who are skilled in client/server programming is increasing dramatically.

Increasing numbers of companies, ranging from local businesses such as Exodus Communications in Santa Clara, to larger entities such as the Los Angeles Times, Microsoft, Manpower, and Hewlett Packard (HP) list openings for jobs that require Web site administration skills. (Refer to the individual company Web sites and America's Job Bank for the most recent information on available jobs.) Although these jobs are listed variously as, for example, Network Integrator/Software Engineer or Professional Internet Technologist, Data Warehousing Consultant (Microsoft), Backend Web Developer (Manpower), Tech Support/Applications

Specialist (Hewlett Packard), the skills required are those taught in SJCC's Web Site Administration and Application Solutions programs. For example, the Tech Support/Applications specialist at HP must "develop expertise in Web-based client/server development tools/techniques, security tools, and distributed application tools and techniques." The Backend Web Developer (Manpower) must support Internet-based electronic bill payment systems and know Perl, Java, and SQL. The Data Warehousing Consultant (Microsoft) who participates in the design and implementation of data warehousing must have experience using SQL, C, Java, client/server technologies, and Visual Basic. Microsoft is also seeking Applications Development consultants who know Inter/Intranet application development using IIS, IE, ASP, VBScript, Java, HTML, and DHTML. In the area of audio and Web music distribution, companies such as Liquid Audio (http://www.liquidaudio.com) are seeking Web Developers, Web UI Designers, and Web Development engineers proficient in Unix, Perl, Java, C++ and SQL databases.

Although many of these employers may prefer a candidate who has a B.S. in Computer Science, candidates with several years experience and demonstrated subject matter knowledge will also be interviewed regardless of whether or not they have earned a B.S. For example, an Information Architect/DBM at one company needs to know how to design, develop, and manage information architecture and solutions for all business areas and ensure that customers can find information about the business enterprise on the Web. Other jobs with titles such as Professional Internet Technologist require that the candidate possess a knowledge of various Internet-related technologies and Windows NT operating system as well as SQL server.

In the area of Web site management, employers predict that employees capable of performing the following tasks will be in demand as companies attempt to handle increasing volumes of database content:

- Load balancing among servers
- Synchronizing multiple servers in diverse locations
- Optimizing database-driven Web sites capable of cross-browser support

If the current employment trend continues, the demand for full-time employees in the area of Web Site management will increase and the need for those whose skills include only Web page design will decrease. Increasingly, companies are hiring full-time employees to manage their Web sites and multimedia specialists who are under contract with companies such as 3DG to design their Web pages.

Refer to the Monster Board at http://technology.monster.com and JOBTRACK™ at http://www.jobtrak.com/employers.html for the most recent employment and salary information. In addition, the Silicon Valley WebGuild Job Board at http://www.ipronetwork.com/JobBank lists specific jobs in Internet and database development areas as well as a variety of local and international jobs.

California Salaries

The salary depends on the job and amount of experience although software engineering jobs in the Web area generally pay $36,000 to $48,000 as beginning salaries. Web site administrators with experience in multi-platform tools can earn a beginning yearly salary of $55,000 to $60,000. Web page designers and HTML programmers earn $15.00 to $20.00 per hour. According to JOBTRAKÔ and the Monster Board, jobs in Web-related fields are increasing more rapidly than in almost any other area. For full-time employees, the salary depends on skills and experience; for part-time employees the salary averages $15.00 per hour. In addition, interns working in various companies can earn a minimum of $8.00 per hour.

Summer and part-time jobs are also available in the field of Web Site Administration. A part-time Web Site Developer at Merlin Media, Inc. in San Jose can earn $12.00 per hour for no experience to $17 per hour for 2 or more years experience.

According to the Interactive Salary Guide sponsored by Pencom Inc., the following jobs and corresponding salaries are available:

- Web-based Applications Developers earn $35,000 with 0 to 1 years of experience and up to $51,000 with 1 to 2 years of experience. Skills required for this job include a knowledge of Java, Javascript, Perl, Intranet/Extranet applications, Apache Web Server, CGI, ActiveX, NetScape server, and Web-based languages such as HTML and XML.
- Computer software developers with a knowledge of Web servers and Web-based programming languages such as Perl and Javascript can earn from $41,000 with 0 to 1 year of experience to $46,000 with 1 to 2 years of experience.
- Computer programmers who become systems or network administrators can increase their first year salaries by $2,000 from $51,000 to $53,000 by knowing Web server technologies.

(Refer to the Interactive Salary Guide Web site, the SuperSite at http://techjobs.supersites.net/techjobsn2/docs/home/htm: and individual company Web sites for the most recent salary and job information.)

Knowledge, Skills, and Abilities

However, technical skills alone do not guarantee success on a job. Companies are recognizing the importance of general skills that fall under the category of knowledge, skills, and abilities (KSAs). America's Career InfoNet (http://www.acinet.org/acinet.htm) lists several KSAs desired for computer scientists.

Knowledge includes:

- Knowledge of processors and chips
- Knowledge of telecommunications systems
- Facility with the English language

Skills include:

- Active learning and ability to work with new material
- Operations analysis and testing
- Critical thinking

Abilities include:

- Written comprehension and expression
- Oral expression and speech clarity

Vocational Horizons

In additional to technical skills, these KSAs are the qualities that students gain by taking a well-organized logical curriculum leading to an Associate of Science degree. Keeping both the technical requirements and the KSAs in mind, SJCC built a successful Web Site Administration program designed to provide Silicon Valley community college students with the Web-based skills necessary to expand their vocational horizons.

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Pulling It All Together - The Integrated Software Support System

During the 1980's and 1990's there has been a variety of methods for providing users with the information they need to correctly operate software systems. These methods varied from different kinds of training, including classroom, self-paced, and computer-based, to an assortment of documentation methods, including written user manuals, basic online help, browser-based help, and context-sensitive help. In many software companies, the training department and the documentation department have been separate entities, sometimes not even communicating with each other.

Over the past twenty years, we have designed and developed every kind of user support tool from an instructor-led maintenance course introducing digital electronics in 1979, to a web-based support system in 1999. We believe that now it is time to unify all of the user support methods and deliver an integrated performance support system that will supply users with whatever information and tools that they need to operate a software system. That is what we are in the process of doing at E3 Corporation.

While software systems vary widely in purpose and complexity, the essential elements that users need to understand in order to operate them are the same: concepts, principles and procedures. When we explain the concepts upon which a software system is based, we essentially explain what the software does, and the ways in which it can best be used. When we explain the principles, we explain how the software accomplishes its particular tasks. Procedures are the specific steps that need to be followed to accomplish each task that the software does. There is a direct relationship between the elements that users need, and the components of an integrated software support system.

The most precious type of support that we can give users is face-to-face instruction. It is precious for two reasons. One reason is that there is no substitute for one person explaining something to another. No book or computer or television monitor can see whether the learner "gets it." Another reason that it is precious is that it is difficult and costly. Often when a company buys software and has to schedule this type of training, they have to remove entire departments from productive work for days at a time, and may have to incur travel expenses in addition to the time lost. Because it is so valuable, face-to-face, or instructor-led training should be reserved only to teach concepts. It makes sense to reserve the most valuable kind of support to teach concepts because the concepts that underlie a software system are the most important information that we can give users. Once users understand clearly what the software's purpose is, and how it can be used to its optimum effect, then they have the necessary foundation of knowledge to enable them to understand the principles and procedures that make it work.

What is the best way to teach the principle of how to perform a task? We explain it, demonstrate it while

explaining it again, have the learner perform the task, then give feedback; we repeat the performance and feedback until the learner is proficient. This type of learning is perfectly suited to computer-based-training (CBT). We consider the term CBT to include web-based training, since essentially web-based training is CBT delivered over the web. Well-developed CBT follows the exact teaching steps that are best for learners to understand principles. The most important step in the development of CBT is the design. The body of knowledge required to operate the software system must be separated into segments that are not only the correct size and complexity for one CBT course, but are also logical components of the different jobs that users perform. The keys to good CBT are thorough explanations of what the learner is to do, complete usability testing before deployment, and adequate trial and feedback before testing.

In simplest terms, a procedure is a list of steps that a user needs to follow to complete a task. When delivering procedures to users, the most important points to consider are to make sure that the procedure can be found as quickly as possible, and that the procedure includes the right level of explanation for the user. We have found that the most effective way to deliver procedural information with current technology is via a browser-based, HTML support system. This system can be linked directly to the application and installed on individual PCs, or it can be delivered as web-help over the Internet. Either way the user can get to the information immediately, without leaving the working application. Once users open the support system, they can find the required information using the table of contents, the index, or the full-text search system. Full-text search enables them to locate the correct procedure even when they do not know enough to know where to look. We design the explanation of a procedure so that it contains enough knowledge for the least experienced user, but we use such features as Dynamic HTML to "hide" cumbersome information such as field descriptions and screen shots from the more experienced users. We include on-screen demonstrations and on-the-fly CBT if necessary.

To summarize, we will use the specific situation at E3 Corporation as an example. E3 has a selection of software applications that control inventory replenishment and perform demand chain management. Project managers, buyers, merchandisers, inventory analysts, and suppliers use these products. For this example we will use a buyer as the user in question. Once his (or her) company has purchased the E3 product, the buyer will attend a one-day seminar where he will learn what the software does and how he can best use it to increase the company's profit. Then the buyer will be given a CBT program to follow and a password to the E3CAMPUS web site. When he returns to his company, he will be able to log on and complete the courses for a Level 1 Buyer. When he starts using the software he will have access to a comprehensive HTML-based support system that is tied directly to the software and contains all of the procedural information he needs. He will be able find specific procedures using the table of contents, index, or search features. And at any time, he will be able to log on to the E3CAMPUS site for updates and additional information. There will be a similar integrated software support system for all users and for each product.

The key to developing such a system is that there be one integrated support department. At E3, the Product Support Department analyzes the user requirements for each product. We determine what items of information are concepts and belong in the seminar; what knowledge and skills are essential principles and must be included in the CBT; and how best to deliver the procedures in the online support system. It is inevitable that the same product information will appear in two, or all three of these components and it is critical that the information is always the same, and is always presented consistently. Our department is able to do this, and that is why an integrated support system is so effective and so efficient.

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Detroit Receiving Hospital physicians launch first in the world interactive learning website for physicians

Dr. Lavoisier Cardozo, FACP, chief of medicine, Dr. Nelia Afonso, director of medical education, and Dr. Gurdev Singh, staff physician in internal medicine at Detroit Receiving Hospital, have created a worldwide, medical training first…a Web site that is a teaching tool for physicians and medical students. It is **mdmorningreport.com,** the location of **Morning Report Reviews**…brief accounts of actual patient cases, interactive, and designed to teach.

mdmorningreport.com is the very latest,state-of-the-art, computer-based teaching tool which evolved from the age-old, uniquely American tradition of the daily morning report. That is when physicians, generally residents, present to the faculty, other residents, and staff physicians, the cases they have admitted to the facility while on call the previous 24 hours. Each session serves as a case-based learning activity and ensures that patients receive the best medical care possible.

"Over the years, morning report has become a cornerstone of resident training, in fact it has become one of the most important teaching activities of the physician's day, and training new physicians is a vital mission of the staff at an academic-based, teaching facility like Detroit Receiving. Since we have a wealth of case-based learning material, why not make it available to help other students and physicians to learn via a format that has a proven track record," said Dr. Cardozo. Drs. Cardozo, Afonso and Singh are on the staff at the Wayne State University Medical School where Dr. Cardozo is a professor of internal medicine and Drs. Afonso and Singh are assistant professors.

Morning Report Reviews offers carefully selected, challenging cases that have been presented at Detroit Receiving Hospital during Morning Report. Through an *immediate response*, interactive teaching format, physicians and medical students can read about cases, submit answers to requested information about the cases, and compare their responses to model answers as the cases unfold. *Along with the information about cases, the site will also feature video aids such as 2D echocardiograms complete with sound; images of prepared lab slides and other tests that assist in the diagnosis and treatment planning; and images of the actual medical problems.* Four to six cases per month will be carefully chosen for their ability to enhance clinical skills, and to foster a pathophysiological approach to problem solving and the application of an evidence-based approach to case management.

In a hospital such as Detroit Receiving, many of the cases admitted present complex challenges that many physicians in smaller and less specialized institutions or in less populated areas, may rarely see but from which they can learn**. mdmorningreport.com** now extends access to this exceptional information from Detroit, to even the most remote areas, worldwide, *allowing many physicians to provide better care for their patients.*

But **mdmorningreport.com** also offers another boon to physicians. Fifty hours of Continuing Medical Education (CME) credit. "Every year, physicians are required to accumulate 50 hours of CME and **Morning Report Reviews** can provide them with all of the hours they need, at no cost. They log in, review the cases and immediately upon *successful* completion of each response, receive one hour of Category 1 CME credit, per case. *The physician can actually print a certificate of proof that the hour has been earned.* The

experience is designed to help residents and physicians prepare for their Board certification and re-certification examinations," Dr. Cardozo added.

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Mentally Preparing Boy Scouts for the Future

In the Boy Scout oath, a Scout promises to keep himself physically strong, mentally awake and morally straight. A Scout knows that proper eating and exercise can keep him physically strong and a reverent family will keep him morally straight, but in today's society what does it take for a Scout to stay mentally awake.

The merit badges in Scouting allow a Scout to develop his mind and increase his knowledge in various areas of interest such as camping, citizenship in the nation, personal fitness and first aid. Scouts gather information and learn new skills that will challenge them, will keep them mentally awake and may even prepare them for their lifework.

Daryl Mancinelli, Scout Executive in the Columbia-Montour Council Bloomsburg, Pennsylvania, believes he can improve upon an already successful merit badge program and prepare his Scouts for their future by adding technology to the learning environment.

Through a cooperative effort with the Department of Instructional Technology at Bloomsburg University, the Columbia-Montour Council developed a computer-based instructional program that will prepare the Scouts for their first aid merit badge requirements and encourage Scouts to explore and become more familiar with computers.

Designed by graduate students John Caputo (Eagle Scout), Nadia Hristova, and Todd Mazurick, this instructional program (**On the Trail to Eagle: Be Prepared for your First Aid Merit Badge**) takes the Scout out on a virtual hiking trip. Utilizing various multimedia tools the group designed an attention-gaining introduction that informs Scouts why they should participate in obtaining merit badges.

Before heading out on the trail the Scout assembles his first aid kit. From a collection of 18 items, the Scout must select the 13 items required for the patrol first aid kit. The Scout is then ready to begin his virtual hike.

During the hike, the Scout encounters various first aid situations. The situations are similar to what the Scout could encounter on any normal hiking trip such as a fracture, severe bleeding, hypothermia/frostbite or something as common as a bee sting. During each scenario the Scout is informed what the situation is. The Scout is then asked a multiple-choice question on what the best course of action would be. If the Scout is not quite sure what the correct answer is, they can ask for assistance. A small button with the image of an eagle allows the Scout to search for the appropriate treatment. The eagle provides the exact course of action

as described in the first aid merit badge booklet.

After selecting their response to the question, the Scout is provided with positive feedback if they answer correctly. If they do not answer correctly, the program provides the correct method of treatment.

The program tracks the Scout's progress as they travel through the hike. At the end of the program, the Scout can print out the final screen that shows how he answered for each individual question and to what first aid requirement it applies to. The Scout will then give the print out to their first aid counselor. The counselor can then use these results to further enhance the instruction during the first aid merit badge.

Initial reaction to the program has been positive from both the Scouts and the first aid counselors. The Scouts found the program to be an interesting and fun way to prepare for their first aid merit badge.

The program was initially designed for Scouts who have not yet received their first aid merit badge, however, experienced Scouts who reviewed the program felt it was a great way to review their first aid skills and keep them mentally awake in this technological age.

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Italian in a MOO

The Project

One of the main difficulties in teaching a language abroad (e.g. Italian) is, of course, the fact that the learning process must take place mostly in a country where the language is not spoken. Language and culture from a country can be taught only up to a certain degree. Since only direct immersion in a community of native-speakers and confrontation with the (often idiosyncratic) real use of the language can provide further improvement, ideally the learners should spend a long time in the target language country. This can be difficult and expensive.

The existence of an online community of native-speakers dwelling in an Italian environment can be of great help in solving both the problem of expense and that of reaching a higher level of proficiency in Italian.

The MOO called LittleItaly hosts such a community.

What is a MOO

A MOO (MUD [Multi User Domain] - Object Oriented) is a text-based virtual environment where written communication happens in real time.

All MOOs are alike in that they are online textual representations of physical environments. All MOOs are different with respect to the theme of the physical environment that they choose to represent.

To enter LittleItaly means to enter an Italian environment where everything that happens or is there, is in Italian. A series of "rooms" (squares, shops, monuments, streets, proper rooms, etc.), a variety of objects (books, signs, machines, etc), a population of over 2000 native-speakers of Italian: everything and everybody must be dealt with in Italian.

You enter LittleItaly and you move around typing commands in Italian, you read the Italian description of the places where you get and of the objects you want to use; you meet people and you communicate with them writing what you want to say, in Italian, of course.

There is no picture, whatever you see, is seen through reading. There is no sound, whatever you hear is heard through reading. There is no voice, whatever you say, is said through writing. There is no movement, wherever you move, you move through writing. Whatever you do, is done trough reading and writing. 99% of the actions and interactions in LittleItaly happen through Italian (yes, there is a small percentage of commands which are in English, because the origin of the MOO is English, but this has little or no influence on the language used within LittleItaly).

LittleItaly is an entirely Italian MOO, created for research and teaching purposes originally linked to the Information Sciences, which has evolved into a vast community of people with varied interests.

Who

The project involves mainly second year students of Italian (on a lesser scale, fourth and fifth year students) of the Department of Italian of the University of Glasgow (U.K.). Their knowledge of the language ranges from "lower intermediate" to "higher intermediate" and "advanced". Second year students who want to procede to an Honours Degree (Single or Joint) must spend their third year abroad, often in Italy.

An Italian MOO seems to be the ideal opportunity to prepare for their Italian experience and, after that, to allow them to keep up their practice of the language.

Why

The main aim of the project is to develop the Italian communication skills of the students through their active participation in the life of LittleItaly.

A second, more specific aim is to provide a series of language activities some of which are part of their curricula and can be integrated in the continuous assessment practice.

How

Within LittleItaly, a series of rooms have been created which are specifically dedicated to our students. In one of these rooms (the Language Room) they can find language games and exercises; in another (the Assignments Room) they can find and do their language assignments which then will be sent automatically

(via e.mail) to their tutor, for correction and assessment.

Apart from this more formal language training, the students can "socialize" in LittleItaly: meet and communicate, in Italian, with other students of Italian or, more often, with Italians. Although LittleItaly is a MOO, where, by definition, all communication is written, the ways in which communication happens and the fact that it happens in real time introduce many of the characteristics of the spoken language. This is even more productive from the point of view of the general aim of the project if we consider that the students act in an entirely Italian environment where many aspects of non verbal communication (although expressed through writing) are also present.

When

After some training in the use of the MOO, with two or three joint sesions where the tutor is present both virtually (in LittleItaly) and phisycally (in the computer room), the students can access LittleItaly whenever they want.

They can enter the students room and do the exercises at any time and they can "socialize" whenever other people are connected. Unlike what happens on other MOOs dedicated to language teaching, in LittleItaly native Italian speakers are present at any time of the day and during most of the night.

Where

In LittleItalyMOO, which is hosted on a machine in the DSI (Department of Information Science) of the University of Milan (Italy), students form Glasgow University can meet people connecting from all over Italy (but there is also a growing number of connections from Italians living all over the world).

LittleItaly- Host: little.usr.dsi.unimi.it Port: 4444 (MOOs are accessed via client programs like Telnet.)

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Best Practices/Internet Project: Is Internet-based dissemination of evidence-based practice information effective?

Introduction

This project originated in response to the dynamic and increasingly complex environment of community health services. At a time when resource constraints are affecting community health agencies across Canada, there is a growing need for evidence-based programs, that is programs which integrate existing research and theoretical knowledge about effective and efficient community health practice. This knowledge base informs the development of "best practices" (i.e. assessment protocols and intervention strategies for effective community health practice).

Four content domains for best practices were selected for this project;

- Falls Prevention for Seniors
- Postpartum Support (includes prevention of smoking relapse)
- HIV Prevention
- Physical Activity/Exercise

Particpants self-selected their domain of interest based on their area of professional expertise.

A significant focus of the project is to identify how conventional but expensive modes of continuing education delivery, i.e. face-to-face workshops, conferences and print-based learning packages can be replaced by more cost-effective strategies for engaging learners electronically.

There is limited but growing literature describing use of the Internet as a continuing education training tool and as a means for disseminating best practice guidelines for community health. Although there are many descriptions of the cost-effectiveness of computer-mediated instruction (CML) and benefits relating to user satisfaction, i.e. place & time independence, learner participation, self-paced learning, effect on self-efficacy, learner control and peer support, few authors have compared learning outcomes between print-based groups to on-line groups. Barker, Klutman, Scott and White (1987) and Lawson, Shepherd and Gardner (1991) compared the effectiveness of CML on learning outcomes between a computer-based group and a print-based group. Their results indicated that CML participants learned and retained as much information as those engaged in traditional learning experiences. Neafsey (1997) stated that CML may be a feasible option to print-based study although a print-based group was not included in the study. Furthermore, few studies have described the uptake of best evidence information (Lomas, 1999; NHS Centre for Review Dissemination, 1999). However, several authors note that the Internet may break down barriers between researchers and practitioners (Goldsmith, 1998; Hardey, 1996, Hayden, 1997, Masys, 1998). This randomized controlled study sets out to determine learning outcomes comparing Internet-based group and a print-based group related to uptake of best practices.

Methods

The **goal** of this randomized controlled trial is to examine the effectiveness of an Internet-based strategy for the dissemination and uptake of best practices in community health in Canada. Research **objectives** were to; a) compare the effectiveness of a face-to-face workshop versus an on-line workshop on aspects of program

planning; b) examine the effectiveness of a print-based versus Internet-based strategy for dissemination of information on best practices in community health, and; c) identify user, organizational and technology factors predicting the successful uptake of Internet-based learning regarding best practices. One hundred and eleven community health professionals from 75 organizations and nine Canadian provinces were recruited for this study.

Two treatment conditions are being assessed; a) face-to-face versus on-line learning about use of the Internet and use of logic models for program planning; b) provision of information about best practices via the Internet or in a print-based form. In the first treatment condition, i.e. face-to-face versus on-line learning, ten face-to-face Internet and logic model workshops were conducted in four regions of the country. For those who could not attend the workshops or were randomized not to attend, a web-based learning environment was created. In this environment, participants accessed information about program planning and Internet use on-line.

In the second treatment condition, best practices information is provided either on-line or in print-based form. Participants randomized to receive best practice information on-line also have access to a password-protected bulletin board. These participants are encouraged to join moderated on-line discussions about best practice content posted on the website. Each moderator is an expert in their assigned content domains. On-line information will be updated monthly. Participants randomized to the print-based group will receive best practice information by monthly mailout, no contact will purposively occur between the research team and the print-based participants.

Data collection is taking place at four points in time: prior to and following the Internet training workshop, following the program planning workshop or on-line training, and six months following the delivery of information on best practices.

Summary

The Best Practices/Internet project is contributing to the existing knowledge base on learning technologies in four ways. First, Internet access and patterns of utilization among community health professionals in health departments across Canada will be documented. Second, the effectiveness of an on-line training course for strengthening program planning skills will be assessed. Third, the effectiveness of interactive on-line dissemination of best practices guidelines will be determined. Finally, factors that predict the successful uptake of Internet-based learning in community health will be identified. Each of these contributions will be relevant for those working in community health.

The research investigators are members of the Community Health Research Unit (CHRU), and the University of Ottawa, School of Nursing.

The Best Practices/Internet Project is funded by the Office of Learning Technologies, Human Resources Development Canada.

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Tomorrow's Engineers Learning Actively Today

In 1980 my class of second graders knew nothing about computers. Today the keyboard is as familiar in the classroom as the number 2 pencil. Things have obviously changed. We now live in the information age where the world's knowledge base is doubling every 7 years. Science and technology begets more science and technology and we all reap the benefits. Today we have access to mind boggling amounts of information and new technologies, at our fingertips. There should be nothing stopping us now! But ask any company here in the Silicon Valley what their single greatest hurdle is and you'll hear a unanimous chorus- qualified people. Our educational system is simply not producing enough qualified people to sustain our technological growth. Looking to fill the void by hiring outside our political boundaries is merely a Band-Aid solution. To tackle the problem effectively we need to start at the beginning- by preparing tomorrow's engineers today.

The situation today

To tackle the problem we must understand it. How are our children doing?

- American 13 year olds were found to have the lowest math and science scores of 6 industrial countries surveyed in a National Assessment of Education Progress survey
- According to a Business Week report it will take 50% improvement by the year 2000 for the US to match the Japanese and Europeans in functional literacy, general science and worker training
- US high school dropout rates are climbing at exponential rates having reached as high as 700,000 in one year.

In this age of the information super highway our children have faster access to much more information than previous generations. If this is the case then why are our students falling behind? Recent studies such as the Harvard study entitled "A Private Universe" conclude that historically students have been participating in passive learning. They have been participating in a teacher student "game", so to speak, where the teacher presents the facts and the students memorize them. Tests are taken, the student passes and then the student promptly forgets the information by semester's end. This rote learning by reading & memorization has typically been the template for most curriculums, including science and technology curriculums. The Harvard study concluded that only 20% of information presented by this method is retained. Alternately, active learning or learning by doing produces information retention of 80%. This is nothing new. We've known this for years. Most everyone is familiar with the old Chinese saying attributed to Confucius:

I hear & I forget
I see & I remember
I do & I understand

An excellent example of the effectiveness of this fundamental hands-on learning philosophy is the apprenticeship model that has been used for centuries to learn skills. How can we apply this to our current situation? One excellent method lies in company and educational partnerships. Schools, museums, corporations and non-profit organizations have found some innovative ways to supplement children's education with real world hands-on experiences that allow them to actively participate in their education.

Tackling the Problem

Automation or robotics is a good example of an area of learning ideally suited for an active learning or hands-on teaching approach. Robotics, computers, software, material science and information storage are just a few of today's growth industries. These are the jobs of today and tomorrow. Nationwide companies, universities and teaching museums such as LEGO Corporation, the FIRST group, California Polytechnic State University – San Luis Obispo (Cal Poly), Purdue University, Adept Technology, Inc., the Society of Manufacturing Engineering (SME), the San Jose Tech Museum and San Jose's Children's Discovery Museum have all implemented or participated in some unique programs to interest students of all ages in learning about robotics actively. From elementary school level team competitions to sophisticated working robotic workcells these groups have combined their expertise in an effort to prepare tomorrows engineers for an automated future. Following are a few examples of hands-on learning projects in process today.

Based on this philosophy that children learn best through construction (hands on experiences) rather then instruction, the world's largest toy manufacturer, LEGO corporation, based in Denmark introduced a unique product that enables children to design, build and program autonomous robotics inventions that move, act and think on their own. The product is a kit called the LEGO Mindstorm kit and includes materials to construct and program a robot that includes a robotic arm. The non-profit organization FIRST Foundation has partnered with LEGO and developed a competitive program for young students utilizing this kit. FIRST is an acronym which stands for "For Inspiration and Recognition of Science and Technology". Their mission was to generate an interest in science and engineering among today's youth. The FIRST LEGO League is a competition for students in grades 4 through 9 where teams of 5-7 children are challenged to design, build and program a robot to use in the competition. In the Silicon Valley 6 teams from the Los Alamitos Elementary School (and an additional team in Cincinnati) are being sponsored by America's largest manufacturer of industrial robots, Adept Technology, Inc. Adept designs and manufactures intelligent automation hardware and software products for manufacturers in the electronics, semiconductor, appliances, telecommunications, pharmaceutical, food processing, and automotive components industries. Four engineers from Adept are participating as mentors for the groups.

Rajeev Bhalla and Mark Ringlstetter, engineers and LEGO League mentors, comment on and describe the program process. Rajeev explains, "with the funds from the sponsors we purchase the First LEGO League (FLL) tournament set that includes all the parts and pieces needed to construct and program an FLL robot. We meet with the students each week for 8 weeks to coach them through the processes involved in designing, building and programming the robot." Mark adds, "The challenge is to be able to maneuver the robot through a course and complete several "missions" within a three minute timeframe. After the 8 week period we meet for the statewide tournament."

"The FIRST Lego League program has been extremely well thought out and developed by the FIRST team. The kids are having a blast and they're learning leadership and teamwork skills that will be extremely valuable to them in the years that come" says Chris Hogan, the parent coordinator for the Los Alamitos teams.

Devin Blizzard, Principal of the Los Alamitos Elementary School adds, "The program truly offers a cross-curriculum learning experience. The kids are not only involved in science and math using scientific theories and formulas but also in English, and social studies by recording their progress and studying the evolution of robotics."

Working at the elementary and middle school level is vital to accomplishing the goal of preparing tomorrow's engineers. What about some engineers a little closer to joining today's workforce? Two universities also know the value of the active learning approach and have implemented their own programs to give their students a real world learning experience. Cal Poly's new teaching environment, the Teaching Factory, makes use of production equipment, computer hardware and software to provide students with a single area where hardware and software systems can be used in the context of an entire manufacturing enterprise. The Teaching Factory is a two-year project funded in part by Cal Poly Plan funds and funds from the Society of Manufacturing Engineering (SME). It includes The Adept Technology Automation Cell, which utilizes

donated automation hardware and software products. The automation cell provides a focus area where material handling systems, including simulation systems and robots can be used to give students hands-on automation experience for class, team and senior projects, graduate thesis and applied research projects.

"This state of the art teaching tool enhances our curriculum by giving graduate and undergraduate students the tools they need to develop industrial products from concept and design to the manufacturing of a product," said Dr. Sema Alptekin, chairwoman of Industrial & Manufacturing Engineering Department at California Polytechnic State University.

Purdue University has a similar hands-on approach in their Computer Integrated Manufacturing Technology program in the School of Technology. The program has partnered with many leading edge companies including General Motors, Ford, Adept and Sun Microsystems to develop a fully integrated manufacturing system line for its students to use for a variety of laboratory exercises required in their courses.

"The goal of our program is to provide a truly "hands on, minds on" educational experience which will prepare our students for leadership positions in industry and education" said Professor Bradley C. Harriger, Director of the Manufacturing Center. "The skills they learn here will enable them to make immediate contributions in some of today's most challenging manufacturing environments."

The hands-on experience is not limited to students enrolled in a particular school or university however. Museum's have taken this philosophy to heart as well. In Silicon Valley, the San Jose Tech Museum and the Children's Discovery Museum both feature hands-on exhibits designed to stimulate thinking and learning. These community museums affirm that learning does not end once school is over. The San Jose Tech Museum will soon be featuring two robotics demonstrations loaned from Adept Technology. Each is an interactive robotic demonstration utilizing vision, robotics and automation software. The Children's Discovery Museum is a unique environment were children actively make connections among ideas, people and cultures. For children to age 13 it is first and foremost a place to call their own, offering interactive exhibits and programs that span the arts, science, technology and the humanities. The exhibits invite self-directed activity and learning. And of course they're fun!

The Bottom Line

Here in the Silicon Valley we talk about the "bottom line" and "action items". Well, here it is. The bottom line is we need to prepare our children for the real world and passive learning just won't do it. We have to do more than complain about the receding pool of qualified employees. This article highlighted a few forward looking associations, schools, companies and museums that have taken on as their "action item" the task of providing active learning opportunities for students and the general public. If we can spread this message our children, community, industry and nation will all win. We should all keep in mind that, as Thomas Barlow, CEO of Anderson, Clayton & Company once said, "In the space age the most important space is between the ears".

For more information on the associations and companies mentioned in this article contact

FIRST Lego League- http://www.usfirst.org
LEGO Corporation- http://www.lego.com
California Polytechnic State University- http://www.calpoly.edu
Teaching Factory of Cal Poly- http://virtual.ime.calpoly.edu/vf/
Purdue University- http://www.tech.purdue.edu
Adept Technology, Inc.- http://www.adept.com
Society of Manufacturing Engineering (SME)- http://www.sme.org

The San Jose Tech Museum- http://thetech.org
Children's Discovery Museum- http://cdm.org

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Conference announcements

Pedagogy and media: the digital shift (The evolution in communication)
ICEM-CIME 2000 Conference
16 & 17 November 2000
Geneva, Switzerland
http://www.icem-cime.org

Technology in Teaching and Learning in Higher Education: An International Conference
August 25-27, 2000
Samos Island, Greece
http://www2.nl.edu/conferences

Creating a Virtual Corporate University: E-Learning Best Practices
July 30-August 2, 2000
San Francisco, CA, USA
http://www.corpu.com/conferences/SF2000/home.htm

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