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21st century learning infrastructure project

Abstract

This Research Project was a practical experience for gaining knowledge on web design, streaming content delivery and the creation of online, educational objects and environments. While working for the Information Technology Department for the State of Iowa, this author was involved with the 21st Century Learning Infrastructure Pilot Project, an attempt to provide learners in Iowa with educational content on demand. This content includes streaming video and audio of various content, computer based training objects, web pages, pictures, interactions with each other, etc. This author's responsibilities to the initial Pilot Project were that of lead web designer, creating five web sites in all, streaming media producer and learning management system assistant.

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21st Century Learning Infrastructure Project
(A Joint Effort between the Information Technology Department and the University of Northern Iowa)

A Graduate Project Submitted to the
Division of Educational Technology
Department of Curriculum and Instruction
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts
UNIVERSITY OF NORTHERN IOWA

By
Justin Stone
April, 2000

This Research Project by: Justin Stone

Titled: 21st Century Learning Infrastructure Project

Has been approved as meeting the research requirements for the
Degree of Master of Arts (or Master of Arts of Education).

June 11, 2001
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Abstract

This Research Project was a practical experience for gaining knowledge on web design, streaming content delivery and the creation of online, educational objects and environments. While working for the Information Technology Department for the State of Iowa, this author was involved with the 21st Century Learning Infrastructure Pilot Project, an attempt to provide learners in Iowa with educational content on demand. This content includes streaming video and audio of various content, computer based training objects, web pages, pictures, interactions with each other, etc.

This author's responsibilities to the initial Pilot Project were that of lead web designer, creating five web sites in all, streaming media producer and learning management system assistant.

The following is a list of the sites created for the 21st Century Learning Infrastructure Pilot Project:

- http://www.infoweb.state.ia.us/21
- http://www.infoweb.state.ia.us/21support
- http://www.infoweb.state.ia.us/eteacher
- http://www.infoweb.state.ia.us/estudent
- http://www.infoweb.state.ia.us/knowledgecomm

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Overview of 21st Century Learning Infrastructure

The State of Iowa Information Technology Department and the University of Northern Iowa, Information Technology Services-Education Technology, have been granted money from state government to enhance learning in Iowa. The project, called the 21st Century Learning Infrastructure, was created by then Director of the Educational Technology Department at the University of Northern Iowa (UNI), Richard Varn, who is now the Chief Information Officer for the State of Iowa Information Technology Department (ITD).

The 21st Century Learning Infrastructure (21 CLI) is a vision to distribute many types of electronic media and media objects to Iowa Universities, Community Colleges, Public and Private Colleges, K-12 schools, and citizens of Iowa via the Internet or, in essence, a Wide Area Network (WAN) or a Storage Area Network for the media. Digital Libraries of content, online learning environments, streaming video, and other content will be available to all Iowans. Every student in Iowa will be able to supplement their education with this resource which creates a vast system of life-long learning opportunities. Instructors will be able to enhance their classes with online content, testing materials, and online classroom environments. The 21 CLI will provide a way to enhance the learning process not only in the classroom, but outside it as well.

Goals of Project

Much research and development have been done in the area of computer technologies in the classroom. Much of what we know from that research points towards many advantages and positive experiences when using technology inside and outside of the classroom. The overall goal of the 21 CLI is create an

environment where all Iowans can extend their education and be life-long learners. Another goal is to cut costs associated with education in Iowa. By providing "education on-demand," students will be able to take courses from their homes and instructors will have content (e.g. streaming videos) at their fingertips, saving vast amounts of time, stress, and the process of getting instructional materials from one point to another. For example, the present structure requires a kindergarten teacher who wants a particular video from an AEA to order the video and wait for its delivery to his/her school or pick it up personally. With the 21 CLI, a complete library of video content will be hosted on this statewide system which will allow the teacher to go to a website, search for the video(s) he/she is looking for, and have the video streamed right to that teacher or student's desktop computer.

"The 21 CLI initiative is an effort to enhance, coordinate, and increase current and future distance learning/digital library offerings thereby enabling all citizens of the state of Iowa the increased opportunity to partake in quality life-long learning." (UNI & ITD, 2000)

The ICN and the 21CLI

The main tool for the 21 CLI will be the ICN, which is a statewide, state administered, fiber optics network. The ICN enables hospitals, state and federal government, public defense armories, libraries, schools, and higher education authorized users to communicate via high quality, full-motion video, high-speed Internet connections, and telephones.

Before the existence of the ICN, students in rural sections of Iowa did not have as many educational opportunities as others located near more populated

portions of the state. The ICN has since bridged that gap and granted more educational content to smaller schools and areas (ICN, 1999).

The State of Iowa has made a considerable contribution through the ICN to increase the level of connectivity to education for learners in the State of Iowa. To enhance learning and instruction further, the ICN will have to be upgraded by allocating more bandwidth to successfully pass multimedia objects, such as streaming video, to any school in Iowa.

Seven Components of the 21 CLI

The 21st Century Learning Infrastructure will be composed of seven principal parts. The following is a list of those parts prior to the initiation of the first Pilot Project, which will be discussed later in this paper (UNI & ITD, 2000). Those parts are:

1. Integration: For the purpose of this project, when talking about integration, what the designers of the project were striving for was for one single entity to include all of the pieces of the puzzle ensuring all assets of the project work together properly. This will be an entity that ensures all partners in the project work in a cohesive fashion. So far, both UNI and ITD have served as teammates to put the pieces of the puzzle together.
2. Central and Distributed Storage: This piece of the 21 CLI will be fulfilled by some type of storage solution, not human, that will be a central storage unit for multimedia objects such as video, online courses, digital objects, digital reporting system, courseware, websites, pictures, etc. These objects must also be interchangeable and easily exchangeable so they can be used for as many different learning applications as may be needed.

3. Networking and Connectivity: The ICN will be utilized to distribute educational objects by using the network infrastructure already in place.
4. Distribution: This piece is what makes the 21 CLI so exciting. As mentioned before, educational objects will be distributed to the area schools. The movement of these objects will depend on network connectivity (ISDN, Dial-Up Modem, LAN, WAN, ATM, Inter/Intranet) and various types of storage media such as DVD-ROM, CDs and others.
5. Learning Management: Currently Lotus Learning Space is being used as the learning management system. This tool allows distribution of online courses, creation and distribution of online material, creation of testing material, tracking and management students, as well as, incorporating third party technologies to facilitate communication among all those involved in the learning process.
6. Acquisition: To provide actual content to distribute to Iowa schools, it will be necessary to purchase content or content licenses of both digital and analog objects for customization, brokering, storage, and distribution. Once the 21 CLI is fully operational, ITD will act as a broker between the educators of Iowa and the educational material vendors.
7. Infrastructure Management: The last piece of the 21 CLI is the tool that will enable project employees to exchange data, create reports on system activity, create a secure and authentic environment, provide a help desk, comply with ADA standards, and provide system support. Lariat Media Reports is currently being used to fulfill this requirement.

What will be included in the 21 CLI?

The 21 CLI project focused on the development of one solution to provide a singular management system that will house all of the components of the 21 CLI. Not all elements of the 21 CLI have been filled at this time because it is still in the pilot stage of the project, but this author will explain the systems currently being used to fill some of the 21 CLI needs. Ultimately, the full advantage of all of these elements is that they will be accessible 24 hours a day, seven days a week, 365 days a year (UNI & ITD, 2000). The resources include:

1. Streaming Media or Video on Demand: Using the latest Real Media and QuickTime technologies in streaming media the 21 CLI will provide streamed video at the request of an instructor or student. Currently Real Server 8 is being used to host the Real Media content. This will be discussed in greater depth later in this paper.
2. Visual and Audio Metadata Capture and Transcription: Metadata will be captured from all of the media elements (video, audio, digital photos, animation, etc.) to make them each searchable. Currently Virage is used to allow the author to capture metadata from video, audio and other media elements and then have that metadata make the content searchable. This will be discussed more in-depth later in this paper.
3. Video Conferencing: The next element of the 21 CLI is the ability to conduct full motion video conversations between two or more parties utilizing ICN and Internet connections in conjunction with teacher or student computers rather than moving a class into an ICN room. The unit we are currently using for this is called a PolyCom unit.

4. Live Learning: Live learning experiences that the ICN already offers will be continued.
5. Collaborative Technologies: Tools that allow for collaboration between the instructor and the learner, the instructor and another instructor, and learner and another learner will be included. Examples of this type of technology would be WebCT or Blackboard. This type of product would create a classroom environment to link students to the appropriate digital objects for the course.
6. ADA Compliance: Appropriate measures will be taken to provide those with vision, hearing or physical disabilities the access they deserve.
7. Course Authoring: A tool, which will be determined later, will be used for instructors to create their own courses or select from a third party provider. This environment will also allow the instructors to create their own courses or choose from other preformatted courses. Of course, these courses will be trackable by a learning management system. Three Macromedia products, Authorware, Coursebuilder for Dreamweaver, and Flash 5, will be used to author the online courses for faculty. These courses will also be launched from our learning management system, Lotus Learning Space.
8. Help Desk: A help desk will also be provided for instructors, tech coordinators, AEA technical employees or any other facilitator trying to use the 21CLI. Help websites have also been created to give users a place

to go to find help or support. These sites were created by the author. They are:

- http://www.infoweb.state.ia.us/21support
- http://www.infoweb.state.ia.us/eteacher

9. Authentication/Security: User identification and password protection will be provided to ensure that only authorized or licensed users can access the 21 CLI.
10. Registration: Students will need to register for course materials. Most registration will be done online with an online payment function, but some face-to-face collection may be required.
11. Course Management System: The learning management tool will be able to manage both static learning courses, such as a WebCT course, or an online course that is passed to your machine, such as a course created in Macromedia Authorware, Coursebuilder for Dreamweaver, Flash 5 or a SmartForce course. This system will track student attendance, progress, use, maintain their records, direct online testing features, assign and reset courses, record test scores, grade quizzes and tests, and create reports for instructors.
12. Data Exchange for Accounting, Billing, and other External Legacy Systems: This system will require the services that could take care of billing, accounting, grading, certifying competencies, creating transcripts, and granting credit. This system would need to correspond with existing state and educational systems.

13. Reporting/Utilization Management: A reporting tool is necessary to generate reports to track the use of the system. Some types of reports that would be needed would be billing records, copyrighted video use, grade reporting, etc. The current system that we are using is called Lariat Media Services.
14. Media Asset Management: This portion of the 21 CLI includes the creating, indexing, cataloging and storage of the media elements in some type of multimedia management system. The elements would be able to be searched, shared, distributed, repurposed, and licensed.
15. Content Brokerage Capabilities: The content utilized by the system will be licensed in the following categories: fair-use content, free content, single copy content, no additional content, and never copy content. There may be some content that may require a fee to use. As mentioned earlier, ITD will act as the content broker between educators and content vendors. The educator's needs will be matched with digital content that will work within the 21 CLI system.
16. Electronic Course Catalog: An online searchable catalog will be created and maintained to show contents and descriptions of the 21 CLI.
17. Digital Library: A repository of both digital and physical materials on demand will be available.
18. Architecture/Flexible Platform Support: The design of the 21 CLI will be one that primarily demands the utilization of the Internet to distribute media elements.

19. Central Storage Management: The main part of the 21 CLI will be a statewide Storage Area Network (SAN) utilizing the ICN connection that is already in place. The central storage system for all elements of the 21 CLI will have to utilize this to the maximum.
20. Interface Architecture Framework: Compliance standards must be met when creating the interface for this product. For example, the 21 CLI must be in compliance with IMS, AICC and other set compliances.
21. Corporate Services: There will be additional services that will be required to enhance the functionality of the 21 CLI. Those are consulting or overseeing of the project, course authoring, educational development, product support from vendors, curriculum planning, instructional development, administrator and user training, and using a third party course solutions.

Pilot Project

This paper has presented the overall vision of the project and its components. The pilot project, which is the first attempt at creating a 21st Century Learning Infrastructure environment, is currently underway. What follows is a discussion of the author's duties with this initial pilot project and what has been accomplished to this point in the project.

The objectives with this initial pilot project are to create a sense of excitement among the members of the education community in the state of Iowa, utilize the ICN to get the content out, and start to get some of the pieces of the project into place. The pilot project is basically a "test-run" to see if all of the parts of the system work correctly together. Initially, the goal is to see if the

system can work, get more funding, and then bring in instructional designers to make sure students are getting the best supplemental material available.

The University of Northern Iowa Education Technology Services and the Information Technology Department for the State of Iowa received one million dollars from the Iowa State Legislature in June of 2000 to carry out this initial pilot project. Up to this point UNI and ITD have acquired many of the 21 pieces of the 21 CLI mentioned in the previous section of this paper. But many of the pieces currently work somewhat independently of each other. The following purchases, installations and project decisions have been made to date:

1. Purchased and installed a learning management system, Lotus Learning Space, and distributed third party computer based learning modules from SmartForce.
2. Generated reports, tracked students, and created authentication (password protection) with Lotus Learning Space.
3. Installed Real Server 8 which distributes Real streaming media which has been encoded by members of the project.
4. Utilized a Polycom unit that allows video conferencing using the ICN and the Internet. This provides full motion video interaction, similar to the ICN.
5. Installed the Virage System which stores metadata taken from media content, such as a streaming video, so that every media element can be searched and indexed.

6. Installed a Lariat Media Reports server to generate reports to show system use.
7. Installed WebCT on a server to serve as a centralized linking point to all services available to instructors and students. WebCT will also be used by the instructors to create their own courses.
8. Purchased and installed fifteen servers: four content storage servers, two Lariat Media reports servers, one Virage server, one Real Server, one Lotus Learning Space server, two FrontPage servers, one broadcast server, one server for Netmeeting. Ten of the fifteen servers purchased have been purchased with ITD funds.
9. Three licenses have been purchased from Real Networks for 600 concurrent clients to view Real video content. Also, three Osprey 100, digital video capture cards have also been purchased.
10. Installed a RAID storage system that provides 1000 gigabytes of storage space for media elements. This is a separate storage unit from the 15 servers mentioned.
11. Tested connections around state and upgraded ICN connections between ITD and the ICN statewide Storage Area Network (SAN).
12. Purchased and licensed physics video content in digital format from a California based media group, Rock Solid Media.
13. Digitized physics videos and made them available for teachers to see along with new websites on content topics. Videos include 600 one to two minute physics demonstrations.

14. Continually meeting with an oversight committee to ensure the project is going in the right direction. Also, the oversight committee has chosen the topic of the media elements that is being distributed in the pilot project. They selected middle school math as the topic, which was available in mid-February of 2001. Content was formatted with Real media, fit into the Virage system and sent to students and educators via the Internet. Members of the oversight committee include Dr. Robert Koob, UNI President, Gary Bozylinsky, UNI ITS Vice President, Ted Stillwell, Department of Education, and Richard Varn, Chief Information Officer for the State of Iowa. This oversight committee reports to a special committee of the legislature.
15. Met with Area Education Agencies to create enthusiasm for project, create a working relationship, and to find educators in their areas who want to partake in the pilot project. So far, seven Schools Districts from Cedar Falls, Cedar Rapids, Iowa City, North Tama, Applington-Parkersburg, Jesup, and Denver have committed to participate in the pilot project.
16. Met with technology coordinators and school administrators at each participating schools to do a technology assessment. Broadband connection upgrades to many of the schools in the pilot project will be completed.
17. Educators and technology coordinators will be trained at UNI to use 21 CLI media search tools and course creation products.

To summarize the pilot project, many tools and regulations that teachers, technology coordinators and school administrators can use to ultimately help students have been created. Many of the tools work together to provide successful supplemental learning material. Already in place is:

1. A learning management system with which online learning materials can be distributed and scored.
2. Streaming video and media content.
3. WebCT online classroom environment.
4. Virage media searching unit so users can search all media elements.
5. Lariat Media reports which will track system usage
6. Websites that have been created.

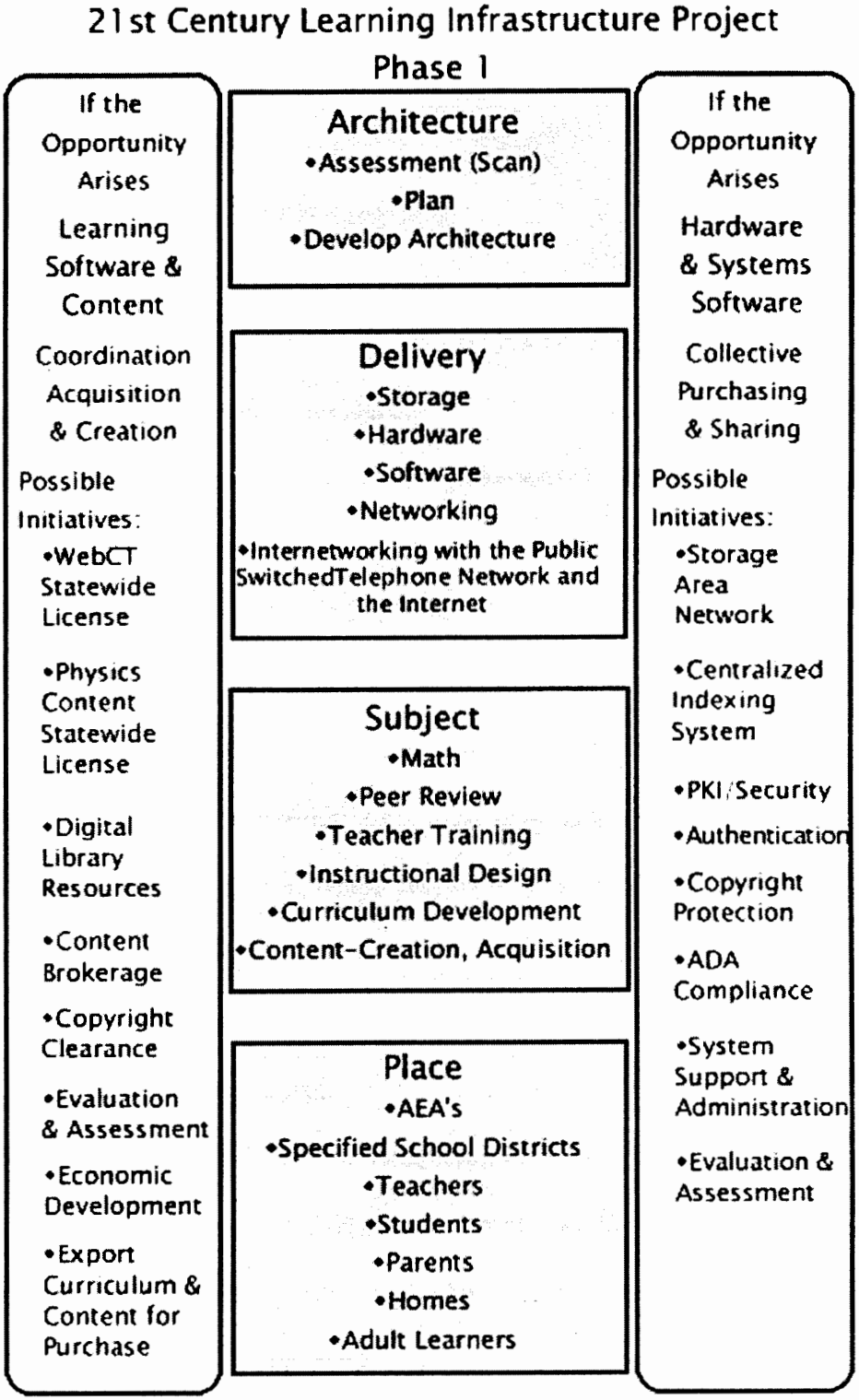
The sites that have been created for the site are:

1. The 21 Century Learning Infrastructure home page. This site was designed to promote and explain the 21 CLI project and pilot project.
2. Knowledge Community site. This site was created to house information for the education department of ITD, the multimedia courseware department of ITD, and as a portal and instructional guide to using Knowledge Access, the working name for the Lotus Learning Space environment.
3. 21 CLI Technical Support site. This site was created to provide technical information and provide many forms of online help such as forms, forums, and chat areas.

4. E-Teacher site. This site was designed for instructors to get current news on the pilot project, search for media for their courses, access online courses they have, create courses, and find support.
5. E-Student site. This is the front-end that students will see when they come to use the 21 CLI. It will allow them to search for media, find online courses, etc.

Figure One shows the steps and elements that will make up this pilot project.

Figure One


21st Century Learning Infrastructure Project
Phase 1
If the Opportunity Arises
Learning Software & Content
Coordination Acquisition & Creation
Possible Initiatives:
•WebCT Statewide License
•Physics Content Statewide License
•Digital Library Resources
•Content Brokerage
•Copyright Clearance
•Evaluation & Assessment
•Economic Development
•Export Curriculum & Content for Purchase
Architecture
•Assessment (Scan)
•Plan
•Develop Architecture
Delivery
•Storage
•Hardware
•Software
•Networking
•Internetworking with the Public SwitchedTelephone Network and the Internet
Subject
•Math
•Peer Review
•Teacher Training
•Instructional Design
•Curriculum Development
•Content-Creation, Acquisition
Place
•AEA's
•Specified School Districts
•Teachers
•Students
•Parents
•Homes
•Adult Learners
If the Opportunity Arises
Hardware & Systems Software
Collective Purchasing & Sharing
Possible Initiatives:
•Storage Area Network
•Centralized Indexing System
•PKI/Security
•Authentication
•Copyright Protection
•ADA Compliance
•System Support & Administration
•Evaluation & Assessment

For the most part, many of the activities in the pilot project have been accomplished. The center boxes on the Figure identify those things that have been completed. During the course of the pilot project those components that are still left unfilled such as obtaining either a WebCT or Blackboard statewide license will be finished.

Overview of This Author's Responsibilities for the Project

Overview

This paper has described the concept surrounding the 21 Century Learning Infrastructure and the pilot project which is currently under way. The responsibilities of this author have included:

1. Creating 21 CLI promotional web site.
2. Creating 21 CLI technical support web site.
3. Creating E-teacher web site for instructors using the 21 CLI.
4. Creating E-student web site for students using the 21 CLI.
5. Creating knowledge community web site to promote the ITD Education and Multimedia Courseware departments and as a portal to the Knowledge Access (Learning Space) site.
6. Capture metadata from digital video for video indexing and searchability.
7. Help to maintain users and SmartForce courses on Learning Space.

8. Prepare video and other media to be streamed via the Internet. Predominantly work with Real Server 8, Real Producer 8, and the Virage Metadata encoding system.

Detailed Report of Duties and Responsibilities

Before beginning with the description of the author's responsibilities for this project, preparation and web design theory must first be discussed. As the lead web designer for this project, it was the author's responsibility to research, create and maintain web sites that were easily understandable by all people involved in the 21st Century Learning Infrastructure. Most of the author's knowledge of how to design web pages comes from observation and trial and error, but the basic information was found in the research in the field of instructional design and web design.

Williams and Tollet (1997) list four main guidelines for web design which this author used in every web site he desiged. The first guideline is using contrast to set apart information that is pertinent information that must get across to the person(s) viewing the site. A web designer can create contrast by using color, text, graphics or combinations of each.

The next guideline is to use repetition to create a sense on uniformity and familiarity in a site (Williams & Tollet, 1997). Not only does this give the site a sense of familiarity, it also makes the site easier to navigate by the user.

The next guideline in William and Tollet's (1997) book is to use alignment. Alignment is simple alignment of text, graphics, backgrounds, etc.

with each other. This creates a site that is cleaner and more appealing to the eye. It also is a way to link like materials together to create uniformity.

William and Tollet's (1997) last guideline to good web design is using proximity. This means keeping similar information together to make finding something in the site easier. Once again, this is another way to create an environment that is easy for the user to understand (Williams & Tollet, 1997).

Much of web design is like the instructional design process, before the actual design of the web site, much research must go into several questions, like:

- What is the purpose of the site?
- What content is to be included?
- Who is the intended audience of the site?
- What types of equipment will the user have? Connection speed to the Internet?

Before the author created the sites for the 21st CLI, the content to be included was included. As a web designer though, it was the duty of the designer to ensure that the content was accurate, relevant and was such that the site could be revisited time and time again for new information. When designing a site it is important to ask the question, "Why would someone visit this site again?" Content selection is a large contributor to a person re-visiting a site. It is the goal of the author to create sites that keep users of the 21st CLI coming back to use the site more than once or twice (Flanders & Willis, 1996).

Another technique to keep users coming back to get content is to continually add new information to the site. The purpose of the 21st CLI sites is to inform users, teachers and students, of breaking news in the world of educational technology and with the project itself (Flanders & Willis, 1996).

After solidifying content and doing a needs assessment of what is to be included in the site and for whom, a storyboard is needed to layout how the site will look and how it will be navigated. To create a storyboard, the designer lays out the pages to be included in the site in a flowchart, displaying the flow a user would take from each page. This is to give the designer a "road map" for how the site will come together (Flanders & Willis, 1996).

Next in the process of preparation of web sites for the 21st CLI, the technological capabilities of the schools involved had to be assessed. Since the sites would be seen by teachers and students in K-12 schools across Iowa, the sites had to be designed that look acceptable on all computer platforms running different versions of we browser software with a slower Internet connections. Keeping this in mind, the author had to design a site that ran fast even on a slower connection. To do this, consideration had to be paid to graphic file size (Parker, 1997). Also, considerable attention had to be paid to maintaining a consistent look in both Internet Explorer and Netscape Navigator browsers. It is key to check a web site on as many different computers as possible to ensure all users are seeing the same thing.

The last area the author considered before creating the site was the use of navigation. Either graphics or text can be used to create navigation within a site

and to other people's site, but there is one main premise that must be accomplished by the designer, consistency. Navigation should always be located in the same place to provide easy access to information and avoid confusion for the user (Flanders & Willis, 1996). One way to provide consistency in navigation is with the use of frames on a web page. Frames act like web pages independent of each other except that one frame can control the view of the other (Flanders & Willis, 1997). For example, in three sites created for the 21st CLI, the author used a separate frame to enclose the navigation, so that no matter where the user went in the site, the navigation would always appear in that separate frame.

The following is a list of the responsibilities of the author for the 21st CLI:

1. Description: 21 Century Learning Infrastructure web site.

The author's responsibilities for this project were to create a promotional site for the 21 CLI where the following information could be displayed: project background information, Request For Information (RFI) material that was sent to vendors, and Pilot Project information. An online form was created so questions could be submitted directly to an email address.

The author was given creative freedom on this site to make the site user friendly. The intent was to make the site very clean and business like. A simple title bar, easy to read color scheme, and a very functional navigation bar on the right side of the page made the page easy to use.

The project committee provided the text for content. The RFI material was divided into four different pages because it was too long for a single page.

The site also consists of an online form that sends the contents of what is entered into the fields by the user to an email address, text file, or database.

As with all web sites, an effort was made to ensure the site navigation was easy, thus the reason for placing navigation bar on the side of each page. The author tested to ensure the site would work in each type of browser and computer. As a rule of thumb for all of the web sites done for this project each page on the site is no wider than 640 pixels wide so users with smaller screen resolutions do not have to scroll left of right.

Another functionality issue that must be considered and dealt with when creating a web site is time to access the site. To create a page that loads quickly all images must be "sliced" or "cut up," into smaller graphics. Computers can load multiple images faster than one large image. Also, to create the rollover effect, graphics are cut up so when the mouse rolls over a particular graphic, only that graphic is changed. The graphic is changed by a JavaScript that tells the browser, when the mouse is rolled over one graphic, replace with it with another graphic. Then after the mouse goes to another point in the page, the graphic changes back to the original.

2. Description: 21 CLI Technical Support web site.

The objective in this project was to create a site for technical coordinators at AEA's and K-12 schools, teachers and school administrators and AEA's participating in the pilot project. This will be a site where they could come to get information on software supported by this pilot project such as Real Server 8, Real Player 8, Real Proxy Server, Lotus Learning Space, WebCT, Netscape and

Internet Explorer browser configuration, and more. This site also contains a forum, which allows those using the system to post comments, concerns or questions, and allows others to respond to those comments. Also included in the site is contact information for technical administrators for the project and a search feature that will allow them to search the site and the forum postings for keywords.

The 21 CLI technical support site will contain a chat feature to further foster communication among those using the system. This feature has not been added because the appropriate software has not been identified.

The author wanted to create something that filled up the entire browser window no matter what resolution or size of monitor that was used. An effort was made to ensure the site was simple to use. The importance of this site was more in the information and the functionality.

A navigation bar that never moves to ensure better navigation is located on the right side of the screen. This page has a kind of wide screen effect by split up into three sections. The top 20% of the page, in red, was dedicated to the title of the page and some simple navigation tools in the upper right hand corner of the page. The middle 65% section was dedicated to two purposes: housing the content in the left frame and the navigation in the right frame. Whenever the user clicks on a navigation choice in the right frame in the middle section, it either appears in a new window all together or in the left frame of the middle section of the 21 CLI technical support page. The bottom 15% section, in black, is used to display when the site is updated.

The 21 CLI technical support site contained a forum, search capabilities, a contact form, and a technical survey. To get the site to actually "stretch" across and resize to the size of monitor or resolution the user was currently running, graphics were put into cells, in a table, with exact pixel measurements according to the size of the graphic. But, instead of using exact pixel measurements for the whole table, certain cells in the table were left blank in a similar color and the cell was set at 100 percent, rather than an exact amount. This actually is what makes the table stretch to fit the screen. For example, on the top frame, in red, three columns and a one row table was created and set it at 100% of the screen size. It stretches to any size of monitor where it is displayed. One graphic on the left side was inserted and indicated that cell had to be exactly as wide as that graphic. The same thing was done on the right side. In the middle cell, the background color was marked as the same as the main colors in the two outside graphics, and set it at 100 percent. The two outside graphics equaled 640 pixels so if a person had a browser or monitor that was set larger than that, the middle cell would force the two graphics to the far right and left of the screen. This makes the site look like it is re-sizing itself, which, in fact, it is.

3. Description: E-Teacher web site.

The plan was to create a site for teachers from the pilot project schools to facilitate the search for media (streaming videos) with Virage, find support from 21 CLI tech support page, create and use online courses with WebCT and Lotus Learning Space, and find useful news and web links to information concerning

the 21 CLI project and e-learning in general. This would be the primary means of communication between the teachers and the 21 CLI content.

The design was more of a portal type web page that offered a lot of different information. The navigation bar on the left was an attempt to create multiple activities for the user. In the navigation bar, an interactive menu, a clock, and a "Did you know" section, which flashes up different facts about computing every few seconds was included.

Before creating the site, different teacher help sites on the Internet were examined. Many of them used lighter colors and even pastels. It was decided to create the site with the predominant color to be lighter pastel green with white and dark blue offsets. Also, to go along with the teacher theme, rollover effects to change a cartoon looking face on the site were used. When the user rolls the mouse over the menu, the face changes and the description in the comment balloon changes to correspond with the changed picture.

A clock and "Did You Know" section which displays different images were added. Those images are facts about computing and change every few seconds.

In creating this site, a few problems occurred. The first problem related to creating the navigation bar, in the actual content areas, to stay static on the right side of the content itself, but also to stay centered with the content in the middle of the page. This was something that became difficult to resolve, so the decision was to create a static navigation bar on the far left side of the browser window and the content just to the right of that.

One other problem was with the clock in the navigation bar. As all designers do, they check to see what their site looks like on as many different computers and in both Internet Explorer and Netscape Navigator to make sure the site looks and operates consistently. When using Netscape it was noticed that it was not handling the form box that the time was being displayed in the same way as Internet Explorer. Netscape was putting an extra return above the form box. After fixing the problem by taking the return out and checking it again in Netscape, it looked fine again. But, the changes made to make it work in Netscape caused it to not work in Internet Explorer. So to solve the problem, identical sites except for the clock function was created, one site was designed so the clock would work in Netscape and one so that the clock would work in Internet Explorer. Then the first page of the site, the default page, included a JavaScript that checked to see which browser the user was using, automatically directing it to either the Navigator side of the site or the Internet Explorer side of the site.

4. Description: E-Student web site.

A portal-like site for students was created. The site includes a search function for the video content, direction to online courses created by teachers or other educators, directions on how to use the site, news, and a help feature that will allow them to contact someone on the 21 CLI committee to alert students of problems.

The design and functionality of this site are exactly like that of the E-Teacher site. The design is the same except for an alternate coloring scheme and a

few less choices in the navigation menu. The choices in the navigation menu are: student news, search for media, online courses, directions and help.

Also, as in the E-Teacher site, the same problem with the clock function occurred and the same solution was used.

5. Description: Knowledge Community web site.

The goal of this web site was to promote three main areas. The site into the following areas:

Education/Training Department-The first main area is an online promotion of the Education/Training department through the following tools or links:

a. Services Provided: a listing of the different services that this department provides other state agencies.
b. Lab Info.: a description of how Learning Centers at the Hoover building are laid out. Pictures also included which were taken with a digital camera.
c. Course Schedule: listing of upcoming courses that ITD will teach in the learning centers.
d. Course Catalog: a course description of all classes ITD teaches along with prices.
e. Course Registration: online registration form for potential students to register for upcoming courses.

Multimedia-The second main area of the Knowledge Community web site is a promotion and description of Multimedia/Courseware production department at ITD. This section is split up into the following links:

a. Services Provided: a list of the different services that the Multimedia/Courseware Department provides to other state agencies.
b. Staff: a listing of staff members and contact information.
c. Portfolio: a directory to previous work done by this department.
d. Video on-demand: a directory of streaming video content.

Knowledge Access-The third main area of the Knowledge Community is the front end for the Knowledge Access area. This is the online learning environment which consists of computer and web-based training objects. This section was split up into the following links:

a. Course Catalog: a complete listing of all the online SmartForce courses provided.
b. Pricing: price guide for users wanting to use Knowledge Access.
c. Registration: registration instructions and form to download and fax to ITD with signatures.
d. Instructions: directions for using Knowledge Access (Lotus Learning Space and SmartForce courses).
e. Go to Courses: link to go to Knowledge Access (Lotus Learning Space). This is actually where the users will take the online courses.

Also included in the site are sections for links and an "About" section which describes not only the purpose of the Knowledge Community site, but the Knowledge Access portion of the site as well.

For the title bar, something with a lot of color and something that would stretch across the entire screen, no matter what size of monitor or resolutions the user is running was desired. The actual content, or what appears below the title bar and main navigation, which is integrated into the title bar, is not wider than 640 pixels. The only thing that will be cut off in a small browser or monitor will be part of the title bar, which is not important.

To have the ability to stream the video content in the "video-on demand" portion of the multimedia section, all videos were digitized and compressed so they can be streamed

Virage-Metadata Encoding

Using the Virage system, a searchable database for the video content which will be providing the educators in Iowa access to information was created using two programs. Videologger and Audiologger will be used to prepare the physics video content and capture metadata from the videos to allow them to be searchable by students, teachers, etc.

The process of turning the encoded video into metadata is a somewhat tedious process. The Videologger portion of Virage captures still images, or keyframes, of the video every so many seconds or frames, according to how many changes it senses in the video. The Audiologger portion utilizes a voice recognition concept that writes the script for the spoken words in the video and

associates time code in sync with the video stills that Videologger is creating. The end result is a Virage file of metadata that will be ingested into a Virage application server that creates HTML templates for the end user. When a student or teacher comes into the system to look for a video, they can search for a topic, then search through the videos by looking at video stills or reading the actual script and going to an exact point in the video without watching the whole video. The Virage system does not actually play the video, but rather it uses the created metadata to redirect the users to the actual video on our RAID system servers.

Assistant Administrator of Lotus Learning Space

As an assistant to Multimedia Systems Administrator to monitor and update Lotus Learning Space, the author had the opportunity to add students, check use, create user reports, maintain usability and functionality of courses, and field questions from students pertaining to the system.

Preparing Videos for Streaming

Using a VHS deck connected to a computer with an Osprey 100 digital video card, the video was captured with Real Producer 8, digitized and compressed it with a Real Video Codec. This then allows the video to be streamed once it is placed on the Real Server 8 server.

Conclusions and Recommendations

Project Problems

Technical Problems. A firewall is a network protector that does not allow anyone outside of the local area network to view anything inside. For security purposes, even the servers for the 21st Century Learning Infrastructure were placed behind this type of firewall, making the author's responsibilities and the project

worthless. Finally, after months of discussion and procrastination, the 21st Century Learning Infrastructure servers were moved outside of the firewall allowing the content to be viewed by anyone, anywhere in the world.

When ITD purchased Lotus Learning Space, the vendor indicated that SmartForce CBT and WBT courses would run in Learning Space, the learning management system. But, it had only been done one other time in the whole United States. There were many compatibility issues between the two systems and for at least a month, it was not possible to get the courses working properly in the Learning Space environment. The courses would not launch and it was not possible to track students who took the courses. To add to the problem, the courses that were authored by the project would not work in the system either, creating a lot of doubt about using Learning Space. After getting little help from Lotus, the SmartForce courses have been make to work properly, but the project authored courses still need to be repaired to work in the system.

The Physics demonstrations that were bought from the firm out of Los Angeles were sent to us on digital video tape. We did not have the proper tape deck to play them and the players are difficult to locate. The company sent us two tape decks to allow project personnel to view the content. But the problem was that the videos were initially created on laserdisc so while viewing the tape there was no delay for the opening titles and there were pause screens throughout the videos. What was viewed appeared as blips throughout the videos, but they were actually a single frame of video with the demonstration title or options that would appear. The videos were created originally on laserdisc to play in a non-linear

fashion and the user had the leisure of starting the video from any place with the laserdisc remote control. To fix the problem, the editing producer had to digitize all 600 hundred videos and remove the frames with the title and video options. This took extra time that had not been planned for in the project timeline.

A problem with the voice recognition capabilities of Audiologger on the physics videotapes arose. The software was to take the spoken words in the video and convert them to a text script. The problem was that the voice recognition was not 100% accurate. This inaccuracy required an individual from the project to view each of the videos and correct all of the mistakes in the scripts prepared by Audiologger. This is adding an extra month or two to the project.

Probably the most difficult part of the project has been just trying to get all of the different application, servers, and various technologies to work properly together. It also makes the search for solutions more difficult as well because whatever is purchased, must work in the system, which causes a lot of confusion and frustration.

Management Problems- Finding schools, AEAs and teachers who were excited about this project was very difficult. Many possible pilot schools have backed out when confronted with the idea of the extra work it would take to use the 21st CLI in their school. Teachers are a little wary of the system because they think it will take too much time. Besides, do computers really help students learn anyway?

AEAs are not supporting the project because they feel it will slowly remove their role in education. If teachers can bypass the AEA and deliver media elements right to a teacher's computer, than why do they need the AEA?

Both groups of educators are missing the point, this project is not trying to replace anyone. It is not trying to create a new form of teaching nor trying to bypass the AEA. In fact, if the project is a success, help from the AEA will be needed even more. The project is trying to make obtaining media and learning objects by teachers and students quicker and more cost effective. Imagine, rather than a teacher waiting for a video to come from the AEA, that teacher could simply go to the 21 CLI site and get that video immediately. It would save time and money. This pilot project is about seeing if this system is possible and if could help teachers and students learn. If the pilot project is a success, then instructional designers will be included to help teachers and faculty infuse this resource into their current educational systems.

There seems to be a small rift between the two key organizations, ITD and UNI, for project leadership. Both organizations seem to want to assume the power of being in charge when they do not realize that the teachers, students, and taxpayers of Iowa are in charge. A few managerial decisions may have been done to just hurry the project along or were done without consulting the other organization and thus have made the project suffer. An outside official may need to step in and govern the two organizations through this project. An oversight committee is involved, but they are members from each organization, ITD and UNI. It might be more appropriate for an organization representing the audience for the project, e.g. the Iowa Department of Education, to assume a leadership role.

Future of Project

In the next few months, training the teachers how to use the systems for the physics videos will begin. This author will be part of the training team in charge of showing teachers how to use the Virage system to locate video material and possibly how to author their own courses in a WebCT environment.

After this initial pilot project, instructional developers will be hired into help teachers, school administrators, AEA workers, etc. to incorporate the technology properly into the classroom.

After the pilot project, project personnel would like to begin creating learning objects, like SmartForce courses, except in smaller pieces. The objects would either be authored by the teacher or would be authored for them. A "Center for Educational Technology", modeled after UNI's center, should be created for the entire state where multimedia courseware producers would create content for teachers while consulting with instructional developers. Based on the textbooks or learning materials teachers are using in their courses it would be possible to author content that could be inserted into the learning management system. The teachers could then pick and choose from the content provided or buy their own content to reside on the learning management system. ITD could act like a brokerage firm between the educators and the content companies, or could become a content development organization.

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