

Cadet Personalized Educational Gateway

Design and Evaluation of the User Interface

Margaret E. (Peg) Halloran, Ph.D.
Director of Educational Technology

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ABOUT THE AUTHOR:

Margaret (Peg) Halloran received a Ph.D. in Behavioral Ecology from the University of Colorado, Boulder in 1993 and came to the United States Air Force Academy in the fall of 1997 as a Visiting Professor of Biology. In August of 1998, she was hired onto the faculty of the Air Force Academy as the Director of Educational Technology for the Institute of Information Technology Applications.

Dr. Halloran has written several papers and given several talks on the use of the internet in the classroom. She is currently involved in developing a web interface for efficient navigation of USAFA's online educational materials, as well as evaluating the usability of different course management software. In addition to traditional publications, she has published many web-based resources, including a 50-chapter interactive study guide for general biology. Her "Squirrel Almanac" website is recommended by the Encyclopedia Britannica's internet guide, and currently receives over 50 thousand hits per year. The Squirrel Almanac is also consistently ranked among the top 350 sites in Russia. In addition to her research on the educational applications of web technology, Dr. Halloran continues to teach in the biology dept. at USAFA.

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1. Introduction

The World Wide Web (WWW) and its evolving technology provide Air Force users with commercial information technology to enable users more effective processes for accomplishing the mission. At the United States Air Force Academy (USAFA), this technology provides faculty and staff members an effective mechanism for distributing course-related materials and other information by posting it on websites or homepages. Although faculty are quite prolific at publishing these resources, an intuitive navigational infrastructure for finding them once produced is lacking. Without an organizational schema, cadets, faculty and staff spend unnecessary time searching for information and learning multiple software interfaces for similar tasks, time which could be spent gleaning pertinent data from the resource itself.

Many instructors host personal web servers, and many academic departments host departmental web servers with departmental and course related information. However, the naming convention of these servers and the filing system of these web pages are cryptic. Therefore, without the specific address, information within these pages is often impossible to locate, even when the instructor and course number are known. In addition, these resources could not be found from a link within the department's home page. Therefore, it seems that a logical and intuitive navigational interface is needed for web-based resources at USAFA. This could be accomplished by generating web pages for each cadet and faculty member, which act as a gateway to pertinent and essential web resources. This educational gateway should be customizable to act as a personalized information manager that will place on the desktop those items that are accessed frequently or are of high importance.

For example, the cadet's web page would display links to their specific sections of their academic courses, the uniform of the day, information on military and athletic training, and a fully integrated calendar with links to assignment descriptions and practice exams (Figure 1). These web pages could be generated from databases prior to the start of each semester and allow cadets to have textbook, lesson objectives and reading assignment information in advance of the first lesson when syllabi are traditionally handed out. New information could be added to the cadet's personalized educational gateway system database to keep them informed of upcoming changes to the schedule of calls or other happenings in the cadet wing. For faculty, uniform information could also be provided as well as links to the course sections they are teaching, course rosters, research databases and necessary information for their additional duties.

Another problem facing faculty and cadets at the Air Force Academy is a lack of web development tools and guidelines fully supported by both the academic faculty (DF) and the communications squadron (SC). Currently, the Center for Educational Excellence gives workshops on how to use Microsoft's FrontPage, yet based upon recommendations from the Air Force Communication Agency (AFCA), SC supports Netscape's Composer and Macromedia's Dreamweaver. Other faculty members use web development software that is not supported by either organization. The standardization of web development



Figure 1: An example of a homepage on a cadet’s desktop developed by the Cadet Personalized Educational Gateway (CPEG) navigational interface.

tools is difficult because different software packages are favored for the development of different applications, and there is no one package that seems sufficient for all skill levels of developers (AFCA TR 99-10).

However, a web development software package with templates specifically designed for academic courseware (e.g. a web course management tool) that is supported by both DF and SC would be beneficial for faculty inexperienced in web design and authoring. Web course management tools are specifically designed to incorporate many popular course features such as collaborative white boards and discussion groups, thus negating the need for developers to learn multiple packages. In addition, these authoring systems facilitate reusable course content allowing instructors to incorporate pre-existing learning modules, reducing the duplication of effort to produce fundamental widely used course content. This will maximize the time an instructor has to devote to the development of new learning modules and course content.

2. Purpose

The purpose of this paper is to outline a comprehensive and flexible web navigational concept, the Cadet Personalized Educational Gateway (CPEG). To understand how CPEG would interface resources developed by other software, I have provided background information on web development software commonly used in education. This is followed by a description of the interface itself, a list of CPEG requirements and a description of the evaluation of the user interface. The investigation team and a timeline for the study are included at the end of this document. This report defines the research project leading to the creation of a CPEG at the Air Force Academy during the summer of 2000 and a distribution of the research report to other Air Force Organizations in August 2000.

3. Background--Commercial off the shelf web development products

Currently, there are several hundred commercial off the shelf (COTS) products available for developing web applications for educational use. The selection of products is highly volatile as new products are added and other products are removed from the market on a daily basis. These programs range in functionality from Netscape's Composer, which may be sufficient for the authoring text-based web pages to comprehensive course management packages such as BlackBoard's CourseInfo and Universal Learning Technology's WebCT. This section outlines the major categories of web development software and their educational applications.

3.1 Web authoring software

HyperText Markup Language (HTML) is simply a specification for marking plain text files with formatting codes that specify different fonts and styles. It is used to determine the way text, images, and links are shown in a WWW document and is the basis of all web-authoring software. HTML can be typed in as a series of format codes in a plain text editor such as Unix "vi" or Microsoft's "Notepad", or also generated from "What You See is What You Get" (WYSIWYG) web authoring software. Often web authoring software is initially used to create the web page, and the resulting HTML code is modified by the developer.

In January 1999, AFCA completed a study of several COTS web authoring software packages. While all of the packages tested produced functional web pages, NetObjects was not recommended for advanced applications because the HTML code that the package generated was difficult to modify. Macromedia Dreamweaver was determined to be the best overall HTML web authoring tool, yet it lacks a user friendly interface necessary for novice users. While Microsoft's FrontPage '98 easily meets the demands of beginning and intermediate web page builders, some of the features only work when viewed using Microsoft's Internet Explorer web browser. The product also requires installation of server extensions to non-NT servers to function on those platforms. Therefore, its usage is only recommended for an intranet and in settings where all users accessing the web pages are using Microsoft's Internet Explorer web browser.

3.2 Interactive web development software

Interactive or dynamic web sites are more complicated to build than are static web pages built with web authoring tools, but are very useful for posting practice quizzes and other assignments, which provide online feedback to the student and/or instructor about a student's performance. Historically, online quizzes and interactive course materials have been written with JAVA, JavaScript or a common gateway interface (cgi) shell script, such as Perl5. Cgi-scripts write server-side programs that respond to web requests by the web site user. Perl5 and other cgi-scripts generally work across platforms and are supported by both Netscape and Microsoft's Internet Explorer browser, and require programming knowledge to develop.

However, web development packages such as Allaire's Cold Fusion, Microsoft's Visual Studio, and Sun's NetDynamics have built in script authoring tools that enable the developer to build sophisticated interactive web pages, with limited programming knowledge (Seltzer, 1999). In addition, Macromedia has a variety of web development tools specifically designed for building interactive multimedia web pages including Macromedia Director, Flash and Attain Objects for Dreamweaver.

3.3 Collaboration tools

Collaborative tools include bulletin boards for posting announcements and file sharing for group assignments. Students can be assigned to a team project and users at remote sites can then work together on the same file, html document, Microsoft PowerPoint or other document. Electronic whiteboard features are another collaborative tool, which can be used in conjunction with mini-desktop cameras for desktop video-teleconferencing.

Discussion options include asynchronous discussions where participants don't need to communicate at the same time (threaded discussions) and synchronous discussions where participants are logged into a virtual area and communicate at the same time ("chat" sessions). Although synchronous discussions are rarely useful when more than 3 – 5 students are logged simultaneously (Gray, 1998), some programs have session log features that store a text of the discussion, thus increasing their usefulness.

There are currently over 103 software packages available that have some sort of collaborative tool feature – usually asynchronous discussion. Among the more comprehensive packages that bundle together many of these tools into one package include Microsoft's Netmeeting, GTE's InfoWorkspace, and CommonSpace's Collaborative Writing Software.

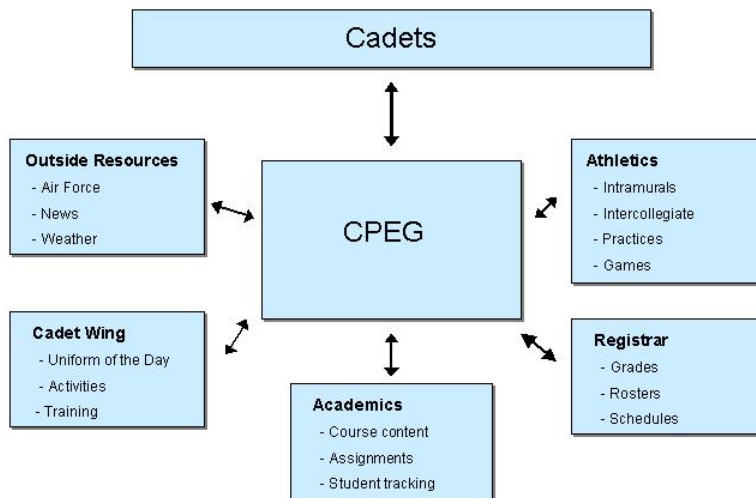
3.4 Course management software

Course management software incorporates many different web development tools into a seamless interface for a single course. Therefore, faculty learn one software package for web-based curriculum, collaborative work, and multimedia/interactive resource development. Although some faculty members are intrinsically interested in learning different software for different applications, other faculty, particularly those less

computer literate or who have demanding schedules, will also be able to develop resources for their courses more efficiently.

Most course management software provides built-in student tracking and assessment features. The assessment features enable instructors to create and administer tests, quizzes and other forms of assessment online. Students can get immediate feedback on their performance along with post-test statistical analyses. Using these tools, instructors can put a time limit on quizzes, and some of these tools allow the random generation of online tests so that no two students get the same question set. Instructors can weight certain questions, and some products customize content provided to an individual student based upon that particular student's performance. Other tools provide for automatic grading of these exercises and the resulting gradebooks are exportable into Microsoft's Excel or other institution specific administrative systems (e.g. Grader).

Student tracking features allow instructors to examine the student's use of these online resources. Some products will identify the IP address from where the student accessed the information and provide detailed student progress information to the instructor, including the date and time students accessed the information, and the number and duration of hits on each course page. This information can be used to make inferences about the interest and difficulty of the content as well as the students' level of effort.



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• **Figure 2: The CPEG interface concept**

4. CPEG--Description

The CPEG interface would build upon the resources already available in the course management software and other databases to provide links for cadets and faculty to online resources at USAFA. For example, the courses in which a cadet is enrolled could be accessed from a database provided by the registrar's office. Instructors could input homework assignment deadlines into a course management database that appear on a modifiable calendar on the cadet's web page. Cadets could post assignments to a web page automatically linked to the instructor's desktop. Announcements, such as a change in the uniform of the day, would be available from changes made to yet another database. And changes in these databases would automatically update the cadet and faculty member's web pages without rewriting the HTML code. In addition there would be links to the bookstore, athletics and web pages external to USAFA (Figure 2).

4.1 Requirements

The software used to produce the Cadet Personalized Educational Gateway (CPEG) and the resulting navigational interface should meet these requirements:

a. Intuitive graphic-based interface

The main purpose of this system is to provide a mechanism for managing web resources efficiently and effectively. Icons and color schemes should be carefully used and the number of steps (mouse clicks and keystrokes) needed to perform a task should be kept to a minimum.

b. Consistent addressing scheme

Web pages for courses should use the department and course number for the address to facilitate navigation without using a search option. For example Biology 215 would be www.usafa.af.mil/dfb/dfb215.

c. Customizable

While all cadets and faculty members will have similar organizational needs, not every individual will want the exact same set of resources on their desktop. For example, some faculty may want to link to the Early Bird, while others may be more interested in the headlines from this morning's New York Times. Therefore faculty and cadets should be able to modify their desktop to delete superfluous links or to add links of interest.

d. Password protection

Different levels of password protection should be built into the system. Faculty should have access to different areas and databases than cadets, and administrators. Similarly cadets and administrators should have privileges to some areas not accessible by faculty.

e. Calendar function

While all cadets and faculty members will have similar organizational needs, not every individual will want the exact same set of resources on their desktop. For example, some faculty may want to link to the Early Bird, while others may be more interested in

the headlines from this morning's New York Times. Therefore faculty and cadets should be able to modify their desktop to delete superfluous links or to add links of interest.

f. *Database generated*

To keep maintenance of the system to a minimum, web pages should be generated and updated from databases. The system should have the ability to update announcements and news items on a continual basis.

g. *Interface with other USAFA databases*

In order for this system to be an effective gateway to internet resources at USAFA, it should interface seamlessly with the databases and web interfaces being constructed elsewhere on base (e.g., course registration databases).

h. *Incorporate functions that cadets/faculty already do*

Faculty already write syllabi, develop worksheets and homework assignments, and enter grades and military performance ratings into databases. This system should not duplicate this effort and require an instructor to perform a task twice.

i. *Interface with other web development software*

This system should provide a seamless interface with web course management software and other tools that are provided by USAFA for web development.

j. *Interface with in-house developed systems*

This system should not prevent faculty from pursuing the creative endeavor of producing new web-based applications. CPEG and any templates included with CPEG, should not hinder web based educational applications being developed (for example) in foreign languages and physics. To this extent, it should support foreign language character fonts and be able to interface with complex mathematical equations.

k. *Relatively easy to learn*

Approximately 23% of faculty and a 25% of cadets are new to USAFA every academic year. Therefore it is critical that both web based course material development and the CPEG interface be easy to learn for novice users.

l. *Course materials must be easy to archive*

As changes are made to existing courses from one term to the next, the option should be available to archive the older versions.

m. *Reusable content*

Instructors should be able to access a departmental database of figures, quizzes, worksheets, multimedia resources, ideas etc with minimal duplication of these items on a single server.

n. *Collaborative workspace and desktop video-teleconferencing capabilities*

Tools used to develop courses should have group collaboration features including presentation space, discussion, collaborative whiteboards, and the capability to adapt these to future desktop video-teleconferencing projects.

o. *Meet IMS specifications*

Currently, there is a lack of a standard set of specifications for web-based resources and web development tools. However, EDUCAUSE's Instructional Management Systems (IMS) project is an initiative to develop a set of technical and design specifications, to facilitate growth and long-term viability of web-based learning resources. Adopting these specifications, developed by members from commercial, academic, and government organizations, may help ensure long-term viability of the project.

p. *Must be able to evaluate prototype using existing IITA lab equipment*

Although the purchase of another type of server is not being ruled out, the initial evaluation of the CPEG prototype will be performed on the current hardware available in the IITA lab (Microsoft NT or Sun Ultra 5 Unix-based servers).

5. Using commercial off the shelf software to develop CPEG

After an exhaustive search of the literature, personal interviews with marketing representatives and faculty at other academic institutions, product review, and demonstrations, only one COTS product has been determined to come close to meeting the requirements stated in Section 4.1 above. Blackboard's Campus product is comprised of several modules including an online personal information manager. This personal information manager provides a unique set of links and announcements based on a user's identity. It presents students and faculty with a calendar of upcoming campus wide and course specific events, links to online course resources and access to other areas of the institution's intranet.

Integral to this system is a suite of course management tools, which includes student tracking, collaborative workspace, web authoring features and a central repository for reusable content. Therefore, Blackboard's Campus software will be evaluated along with other COTS software that meets the requirements stated in 4.1 above and becomes available during the timeframe of this study.

5.1 Evaluation of the CPEG interface

Very often software purchase and implementation decisions are made by technical personnel who base their decision on personal use, attendance at vendor sponsored workshops, reading about it in trade publications, or having used other products from the same vendor. This type of decision-making process, also known as "n of 1" does not take into account the needs and capabilities of the web developers or users. Since implementation of a standard platform could directly affect the workload and ease of information access, it is important to consider the needs of the primary developers and users of the system – faculty, administration and cadets at USAFA. (Hazari, 1998).

Although a particular software system may be evaluated on the basis of many technical criteria, in the end the system must ultimately be judged by its usability: To what degree does it help users accomplish their task(s) and to what degree are the users satisfied with their experience (Levi and Conrad, 1996). Therefore, the evaluation of the CPEG interface will be performed at two levels, the functions it can perform and the usability of those functions. These will be tested in the following manner:

a. Requirements

Commercial off the shelf navigational interface software will be scored using dichotomous (yes/no) variables as to whether it meets or could be modified to meet the requirements as outlined in Section 4.1. This initial evaluation will be conducted by the principal investigator and validated by two other members of the investigation team.

b. Usability testing

A group of USAFA and non-USAFA study subjects ($n \geq 10$) will be chosen to perform a set of specific usability tests on the interface. Non-USAFA personnel will give added insight to impediments that may be experienced by users new to USAFA and will consist of volunteers from other academic institutions and from within the Department of Defense. In addition a group of cadets ($n \geq 10$) will also be chosen to perform the same set of evaluations. The tasks they will be asked to perform consist of the following:

b.1 Layout evaluation

The navigational ability of CPEG will be derived in part by the intuitive nature of the graphical design layout. To test whether this layout (irrespective of content) helps users find key elements, all text on a page can be replaced with unintelligible nonsense, so that the user must rely on the intrinsic communicative aspects of the layout to perform the test task (Nielsen, 1998). Therefore, to test the overall layout of the CPEG design, each test subject will be given a printout where the words have been replaced with nonsense (Figure 3). They will then be asked to draw blocks around key elements of the page such as main content selections (courses, and other links), title, search feature, last updated date and time, intranet identifier or logo, bulletins and news items. Users will also be asked to determine which elements are missing from the page.

Figure 3: Layout evaluation of the CPEG interface. Figure 3a shows the web page as it would be normally viewed, whereas Figure 3b shows the same interface with the text replaced by nonsense.



Figure 3a



Figure 3b

b.2 Ease of use

To test the overall usability of the system, the system will be set up using web pages developed using web course development software (Section 5.2c below). Instructors and cadets will be asked to log-in to the system and perform tasks that mimic real use scenarios. For example, they will have to navigate to certain locations, modify the calendar, and set up a personalized set of links. Data collected will include the number of steps in the process, the number of errors, recovery strategies, time on task and ease of use.

c. Heuristic evaluation

In addition, the site will undergo a modified heuristic analysis to test overall web site usability. This heuristic evaluation will involve a set of experienced web design experts (n = 5) who look for violations of common usability principles such as flexibility and efficiency of use, minimalist design, consistency, and user error prevention (Instone, 1999).

5.2. Evaluation of course management tools

Since course management features will be an integral part of the CPEG interface, it is important to independently test the capabilities and functionality of this type of software to ensure that the overall interface meets the fundamental needs of this niche.

Several studies have evaluated and compared various aspects of course management web tools (Gray, 1998; Hazari, 1998; InfoWorld, 1998; Kristapiazzi, 1998; Marshall, 1998). Of the products available commercially, Blackboard's CourseInfo was consistently rated among the best course management software due to its variety of features and ease of use (Fredrickson, 1999). However, these studies generally focused on checklists of what these products *can do*, not what these products *need to do*, or *can do well*. For example, packages were evaluated by whether or not they had a collaborative white board feature, not whether the whiteboard feature was easy to use or a useful component of the package. These analyses were of limited predictive power in determining the applicability of different software because two or more products may possess the same feature but the feature may not function in the same manner. Therefore, our study will evaluate the usability of web course management packages following the protocol outlined below:

a. Study Participants

A group of instructors (n = 30) and cadets (n = 30) from USAFA will be selected to participate on a volunteer basis to evaluate courseware authoring software packages installed on the computer servers at the Institute for Information Technology Applications (IITA) in Fairchild Hall, USAFA. Participants in this study would be matched for level and variety of experience writing HTML from raw text, using HTML authoring software, and programming of advanced web applications.

b. Requirements

Software packages will be scored using dichotomous (yes/no) variables as to whether they have certain features or allow for the development of key course components (Table 1). The three software packages that have most of the features as outlined in Table 1, and that come closest to meeting all of the requirements of CPEG listed in Section 3.1, will undergo usability testing. Faculty members will also rate how important they feel these components are to their teaching both before and after they learn how to use the software. If appropriate these data may be used to weight the rankings of the software packages.

c. Usability testing

A group of USAFA study subjects will be chosen to perform a set of specific usability tests on, and develop course content with several COTS web management software packages. In addition, a group of cadets will be chosen to perform evaluations on the course web sites produced by the faculty using these packages. The tasks they will be asked to perform consist of the following:

c.1 Layout design

Course templates are an integral part of course management software and allow the novice web developer to post content rapidly. However, before a template is deployed, it would be advantageous to have data on the effectiveness of the template itself. This is often difficult to do because the layout of the template is confounded with its content. To test the effectiveness of different templates they will be tested in a similar manner as described above in section 5.1b. Text will be replaced with nonsense and

subjects will be asked to draw boxes around the key components and to determine which components if any are missing.

c.2 Usability of course authoring system by instructors

Instructor study participants (n = 30) will develop a web site with a syllabus, course information and content for a minimum of one lesson using two of the three web course management tools that are assigned to them at random. Instructors will create course content using the web authoring feature of the software package itself, and import pre-manufactured pages built in FrontPage, PowerPoint, text built HTML, and Macromedia's Dreamweaver to determine the cross compatibility of this system with other development tools already in use at USAFA. Data will be collected automatically and with surveys, and will include time on task, ease of use, and a comparative rating of similar functions for the two course management tools.

c.3 Usability of the web pages by cadets

As discussed earlier, the development of course materials for the WWW is only part of the puzzle. Web course development tools must be evaluated not only by ease of development, but the usability of the resulting web pages. Few, if any published studies have analyzed this component, and studies performed with student subjects are absent from the literature. To test the usability of the course web sites developed with the course management tools in a realistic scenario, cadets will be asked to analyze the resulting web pages that are developed in Section 5.2c.2 of this study. For each course produced, cadets will be asked to access the course, navigate to specific areas within the course, take quizzes, participate in discussions, collaborate on group assignments, find their grade, and perform other tasks necessary to fully test the functional capability of the course. Cadets will also be asked to make predictions on what they will find when selecting key navigational points in the template. Data collected will consist of numbers of steps taken to reach certain navigational goals, ease of use, perception of mental workload, and predictability of certain functions.

c.4 Usability of student tracking information by instructors

Instructors will also evaluate the student tracking features of the system by examining real data from the cadets that log onto the course web-page, as well as simulated hits from the investigators if needed. Data collected will be similar to data collected during the content development phase (Section 5.2c.2) of this study.

6. Laboratory requirements

This project will require a computer with Microsoft NT operating system with an ISS server, and a computer with a Unix based operating system and an Apache web server. The servers must be accessible from outside the firewall for participation by non-USAFA subjects. Each faculty study participant will need a password-protected account with ftp and telnet privileges that allows them access to both machines for development, and storage of their web pages in the CPEG database. Cadet participants will only need a login account to view the pages and submit survey data.

7. Investigation team

Principal Investigator--Dr. Margaret E. (Peg) Halloran, Director of Educational Technology, IITA

Human Factors Consultant--Dr. James Miller, Human-Environmental Research Center (HERC), United States Air Force Academy

Laboratory Configuration Manager--Captain Mance Harmon, IITA

Instructional Design Consultant--Major Stan Supinski, Department of Foreign Languages

8. Proposed timeline

Oct 99 – design survey and metrics for data collection

Nov 99 – download and install course management software, download and install demonstration version of CPEG development software

Nov/Dec 99 – have instructors develop web pages, and collect data. Enter web pages into the CPEG database

Dec 99 – review web pages and add more if necessary to round out sample for cadet analysis. Instructors begin evaluation of CPEG interface

Jan/Feb 00 – have cadets evaluate web pages and CPEG interface, analyze instructor data

Mar 00 – analyze cadet data, write up preliminary results, begin assessing hardware specifications and implementation plan

Apr 00 – present preliminary results of web management software study

9. Product

This project will produce a report that includes the results of the evaluation and specific recommendations for the creation of a CPEG at the Air Force Academy. This report will also be distributed to relevant Air Force organizations

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Table 1: Criteria for Evaluation of Web Course Development Tools for Usability Testing Selection (Section 5.2b)		
	Yes	No
General Features		
Static toolbar		
Table of Contents		
Customized "look and feel" (colors, icons, logos, etc)		
Automated glossary tool		
Automated link to course material content		
Automated indexing tool		
Search tool for course material		
Student can make private annotations of course material		
Integrated Calendar tool		
Multi language support		
Instructor can define groups of students		
--Can assign specific material to individual or group of students		
--Collaborative work area for group		
--Group presentation area		
Individual presentation area/homepage		
Student file upload capability/instructor comments		
Conforms to IMS specifications		
Conforms to W3C specifications		
Authoring features		
Does not require knowledge of HTML		
Allows Java applets		
Requires plug-ins		
Has drag and drop authoring features		
Allows Macromedia files		
Allows FrontPage files		
Allows links to custom developed pages		
Allows custom graphics		

Course Management Features		
Class list can be entered one student at a time, or uploaded as a file		
Class list can be uploaded as a file		
Class lists can be presented, saved, and printed using Excel		
Online student manual		
Online instructor manual		
Course can be downloaded for safekeeping		
Courses can easily be moved from one server to another		
Directory upload capability from desktop		
Student tracking features		
--can track how often student accesses pages		
--can track when student accesses pages		
--can track time spent on each page		
Communication Features		
One to one course email		
One to many course email		
Searchable asynchronous discussion		
Logged synchronous discussion		
Virtual field trips within discussion pages		
Shared whiteboard		
Adaptable for desktop video-teleconferencing		
Grading Features		
Student access to progress data available		
Ability to add offline grades		
Grade statistics and/or histograms		
Instructor comments available with grade		
Scores can be emailed to instructor		
Scores can be stored on server		
Scores can be exported into Excel		

Quizzing features		
Quizzes automatically graded and entered into grade book		
Allows for the following automatically graded question types:		
--True -False/Multiple choice		
--Fill in the blank		
--List matching		
--Essay questions		
--Imagemap (click on correct part of image)		
--Short answer		
Questions can have multiple correct answers		
Can use a mixture of question types on a single quiz		
One question at-a-time testing capability		
Question file upload capability		
Customized feedback		
Redirect path dependent on question answers		
Timed quizzes		
Delivered on-line on a predetermined time and day		
Supports graphics files adjacent to quiz question		
Supports both tutorial and real exam scenarios		
Random assignment of questions to exams		
Allows weighting of questions so students get equal quizzes		
Can be used with the following server /operating systems		
Unix		
NT		
Macintosh		
Solaris		
Linux		
Other		

ABOUT THE INSTITUTE

The Institute for Information Technology Applications (IITA) was formed in 1998 to provide a means to research and investigate new applications of information technology. The Institute encourages research in education and applications of the technology to Air Force problems that have a policy, management, or military importance. Research grants enhance professional development of researchers by providing opportunities to work on actual problems and to develop a professional network.

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Comments pertaining to this report are invited and should be directed to:

Sharon Richardson
Director of Conferences and Publications
Institute for Information Technology Applications
HQ USAFA/DFPS
2354 Fairchild Drive, Suite 6L16D
USAF Academy CO 80840-6258
Tel. (719) 333-2746; Fax (719) 333-2945
e-mail: sharon.richardson@usafa.af.mil