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Improving the Environment in Distance Learning Courses Through the Application of Aesthetic Principles

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Through the Application of Aesthetic Principles

by

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Dedication

I dedicate this thesis to my wife, Laura, and two children, Catherine and Emily. Without their patience, understanding, support, and most of all love, the completion of this work would not have been possible.

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ABSTRACT

Improving the Environment in Distance Learning Courses Through the Application of Aesthetic Principles Learning Environment, Instructional Design, WebCT, Student Perseverance The primary goal of this project has been to research and create aesthetic visual environments in distance-learning media through the application of expert criteria and to explore the effects of those environments on student satisfaction and motivation. To accomplish this three instructors with distinct courses were selected to apply aesthetic criteria within the process of analysis, design, development, implementation, and evaluation. Courses selected were Art Appreciation – ARTS 1100, Advanced Surveying – ENGR 2502, and Introduction to Sociology – SOCI 1101.

The project goal was subdivided into four objectives.

1) Develop criteria for the inclusion of visual aesthetics in the online environment.

2) Design and develop online courses using guidelines for the inclusion of aesthetics.

3) Collect and compare data from students about the level of satisfaction with the aesthetic appearance of the online environment.

4) Explore the effect of an aesthetic environment on student motivation.

This project has demonstrated the environments of distance learning courses can be improved through the application of aesthetic principles. The selected criteria were useful to this Instructional Designer and could prove successful in improving the appearance of other online courses.

Introduction

Over the past three years faculty at Middle Georgia College have increased their use of online and distance-learning teaching methods. WebCT is the primary development and delivery platform for their materials. While training aids and appropriate online presentation techniques have improved online instruction, most educators have not addressed the appearance of the learning environment within WebCT. The aesthetic presentation of course material is an essential element in the design and development of online media and the effects can have a significant impact on student motivation and satisfaction with the distance-learning experience.

Chan (1988) suggests that in a traditional classroom, aesthetics play a role in enhancing student achievement. He states:

> *"An aesthetic environment is perceived as an influential factor on student feelings, and attitudes contributing significantly to positive student learning."*

With distance learning, the figurative classroom is the website or Learning Management System (LMS) that delivers the content. Informal observation has shown that students appear more enthusiastic about courses that have been designed with careful attention to aesthetics. This includes original graphics, interesting layout, and creative means of content presentation (Hathaway, 1984). These creative and technical factors

may be combined to immerse the learner in an aesthetic environment that is engaging and motivating.

The primary goal of this project has been to research and create aesthetic visual environments in distance-learning media through the application of expert criteria and to explore the effects of those environments on student satisfaction and motivation. To accomplish this three instructors with distinct courses were selected to apply aesthetic criteria within the process of analysis, design, development, implementation, and evaluation. Courses selected were Art Appreciation – ARTS 1100, Advanced Surveying – ENGR 2502, and Introduction to Sociology – SOCI 1101.

The project goal was subdivided into the following four objectives.

1) *Develop criteria for the inclusion of visual aesthetics in the online environment.*

A literature review was conducted to explore research published by industry professionals including academics, graphic artists, and interface designers. Criteria were selected in order to form a list of guidelines to be utilized in the design and development of online courses.

2) *Design and develop online courses using guidelines for the inclusion of aesthetics.*

Three online courses were developed utilizing the standard model of instructional design (analyze, design, develop, implement, evaluate) and the list of guidelines produced through the literature review.

3) *Collect and compare data from students about the level of satisfaction with the aesthetic appearance of the online environment.*

Student satisfaction with the online environment was measured through a student opinion survey.

4) *Explore the effect of an aesthetic environment on student motivation.*

Student motivation as expressed through the amount of time spent interacting with course content would be measured in an attempt to study possible effects of the visual environment.

Analysis

Preparation for the project included careful analysis of the project's scope, target population, creative and technological constraints, and the project timeline. The scope was limited to higher education online learning environments that are delivered through Learning Management Systems (LMS) such as WebCT or Blackboard. The project included only undergraduate students.

The project utilized Middle Georgia College students enrolled in one of the three courses selected for the project. In the fall of 2003, the Middle Georgia College student body consisted of 34% minority students, 60% of whom were female. The majority of students were between the ages of 18 and 24. Detailed breakdown of the target audience is recorded in Table 1.

Table 1

Detailed Target Audience Analysis

Item	Weaker learners	Average learners	Stronger learners
Age	18-60	18-24	18-60
Educational level	High school with possible previous college experience	High school with possible previous college experience	High school with possible previous college experience

Continued on the next page

Table 1 (continued)

Detailed Target Audience Analysis

Reading level	Grade 4 – 10	Grade 8 – 12	Grade 10 or better
Motivation	Low	Medium	High
Prerequisite knowledge	ENGR 2502 – preliminary understanding of surveying. Other courses none beyond basic reading and writing.	ENGR 2502 – preliminary understanding of surveying. Other courses none beyond basic reading and writing.	ENGR 2502 – preliminary understanding of surveying. Other courses none beyond basic reading and writing.
Prerequisite skills	None	None	None
Computer facility	Fundamental	Basic	Above average
Web familiarity	Fundamental to good	Fundamental to good	Fundamental to good
Typing ability	Average	Average	Average
Access to computers	Required	Required	Required
Access to Web	Required	Required	Required
Time availability	4 – 10 hours per week	4 – 10 hours per week	4 – 10 hours per week

Other issues:

1) Need to cater to physical disabilities?

   None enrolled but all Level I and Level II Section 508 Priorities should be incorporated as standard practice.

2) More than one language required?

   English only

Project constraints focused primarily on keeping the guidelines and their implementation within the grasp of the typical college instructor, defined as someone who is a subject matter expert in their chosen discipline, but not necessarily in the creative arts or technology. Aesthetic criteria developed during the project needed to be easily accessible and capable of being implemented with common technological resources found in a higher education environment.

The project timeline was relatively simple and conformed to the standard college semester system (Table 2).

Table 2

Project Timeline

	Calendar	Instructional Design Phase	Activities
Evaluation	November 2002 – January 2003	Planning	Initial planning, literature review
	January 2003 – April 2003	Design	Collaboration with faculty, content defined, flowcharts created, aesthetic guidelines developed
	April 2003 – August 2003	Development	Content programmed, aesthetic principles applied, surveys developed, time tracking programming developed
	August 2003 – December 2003	Implementation	Courses taught, data collected and analyzed

Design

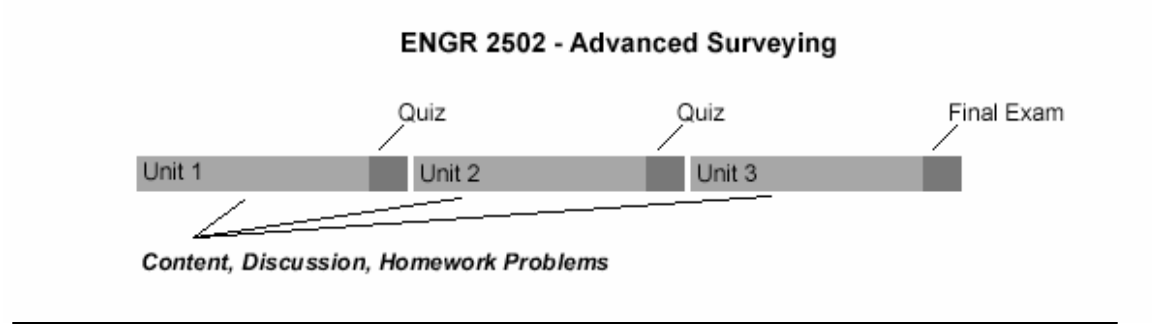
The design of each course began with a casual meeting with each of the faculty members. Their experience with online learning was assessed and steps were taken to "fill-in" or correct any obvious holes or misconceptions. Each of the three faculty members was interested and eager to begin the process of creating an online course. The faculty members served as the Subject Matter Experts for their respective courses and were ultimately responsible for all educational content to be included in the course of study. The Instructional Designer (ID) was responsible for the effective delivery and presentation of instructional material. Additionally, the ID was responsible for all programming, sequencing of content, and methods of facilitation to be used with each class. Some course materials from the traditional classroom setting were adapted for online use.

Course Structure

Chunking of content. The "chunking" of content was the first priority set by the ID. The ENGR 2502 - Advanced Surveying (Figure 1) course relied heavily on the textbook for content in addition to PowerPoint presentations, instructor notes (in PDF format), and related websites. Online quizzes were generally knowledge based while homework assignments from each textbook chapter required higher-level problem solving skills. Course content was divided into three units with each unit containing 5 to 6 chapters of related material. Homework problems required the application of the skills

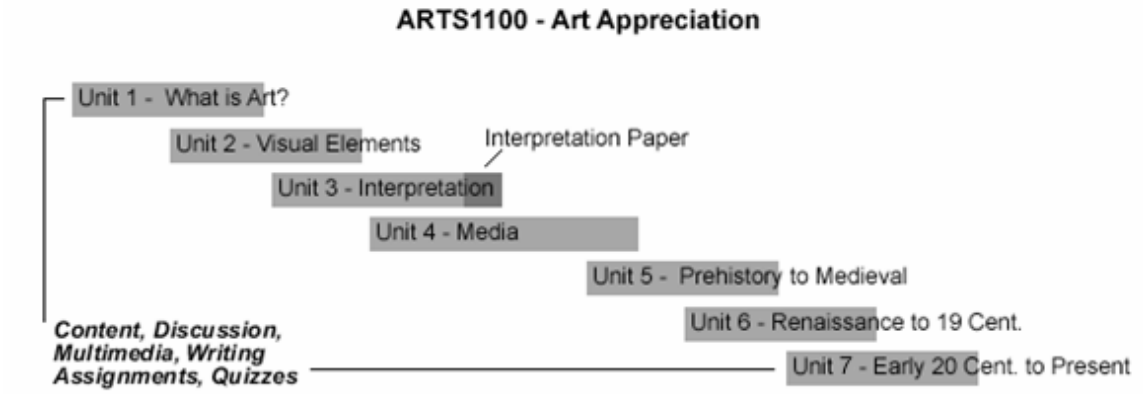
and techniques covered in each chapter and served as a formative assessment for each unit. A comprehensive exam was placed at the end of each unit to serve as a summative assessment for each primary course topic. Interactivity within the Advanced Surveying class was limited to problem solving, discussion of case studies, and exploration of Internet resources.

Figure 1. ENGR 2502 Organization of Content



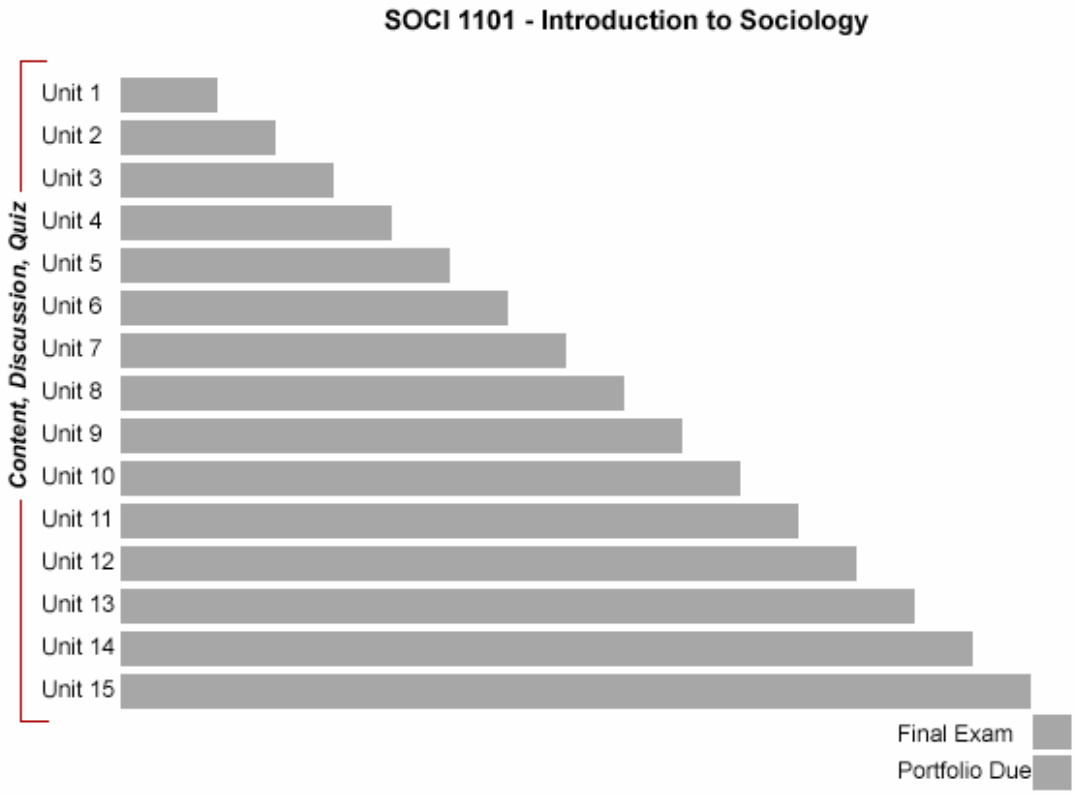
Units for ARTS 1100 - Art Appreciation were determined by content and were presented in sequence to allow difficult concepts to be introduced only after the necessary prerequisite concepts had been mastered. In this manner, issues presented in early units could be addressed throughout the course. Units were presented in an overlapping fashion to help accommodate schedules of distance learning students (Figure 2). Course activities included reading assignments, instructor led discussions, writing assignments, custom multimedia, knowledge based quizzes, a research paper, and an interpretation paper. Discussions were graded on a rubric and required significant interaction with course material and between students. The multimedia lectures extended the content of the text in a creative manner that allowed visual explanations and examples of difficult concepts.

Figure 2. ARTS 1100 Organization of Content



All content for SOCI 1101 - Introduction to Sociology (Figure 3) was made available from the beginning of the course with due dates for units occurring weekly. Students were encouraged to work ahead as the schedule allowed. Units were made up of textbook chapters and followed the same order. The course was consciously designed with constructivist principles in mind. One of the primary course grades came from a portfolio of various items made by the students or collected from print media representing aspects of major sociological topics covered in the class, such as terrorism, abortion, and the exploitation of women in our culture. Introduction to Sociology utilized the discussion tool in WebCT. As with Art Appreciation, students were graded on a rubric requiring the documentation of facts and supporting resources for opinions and/or suggested solutions to current cultural issues. Other course requirements focused on the production of a "Current Events Notebook" containing newsprint, advertisements, and interviews related to social events taking place throughout the semester.

Figure 3. SOCI 1101 Organization of Content



Course page structures. Once the content for each course was broken into units, timelines for delivery throughout the semester were established. Next, flowcharts were created to facilitate programming in the development phase (Figures 4, 5, and 6). Each course was originally designed to run completely within WebCT with the only outside links being to Internet resources; therefore, initial flowchart designs were basic and did not require large amounts of detail.

Figure 4. ENGR 2502 Flowchart

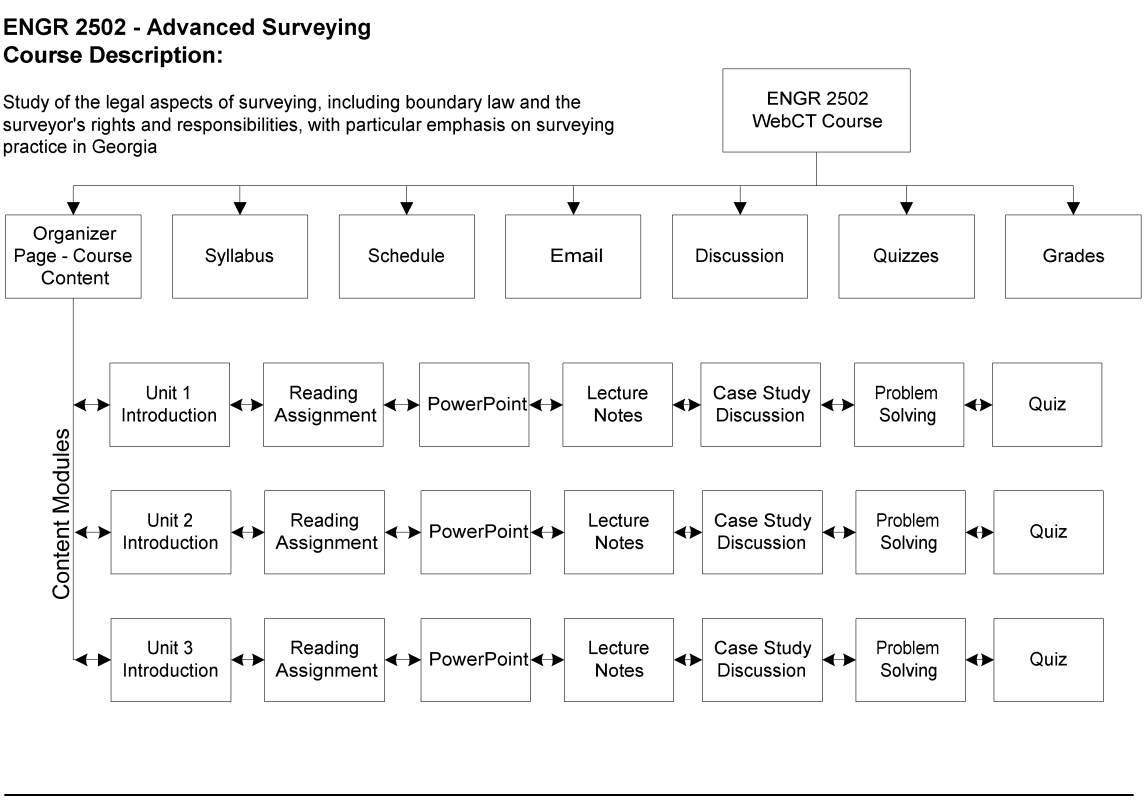


Figure 5. ARTS 1100 Flowchart

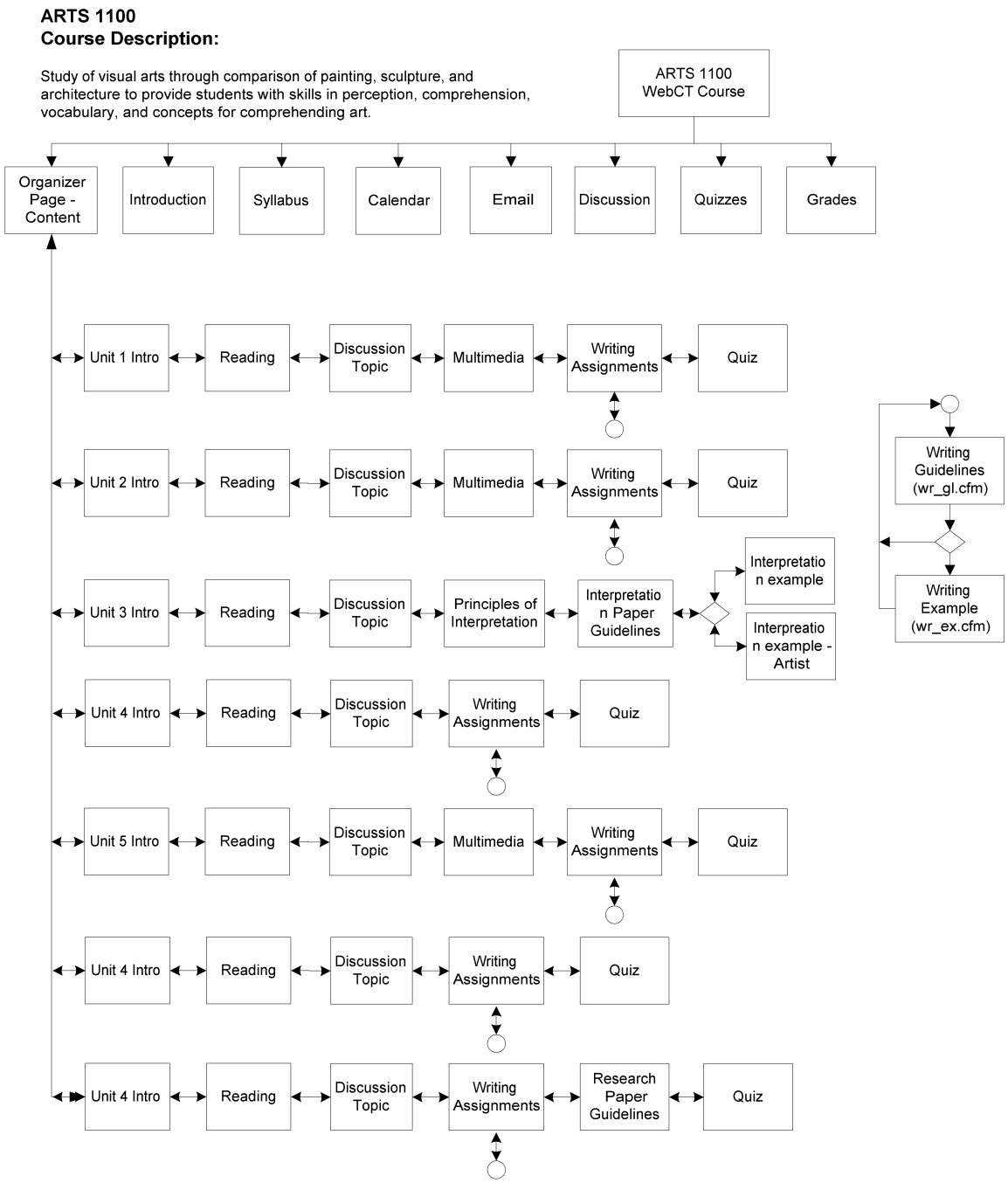
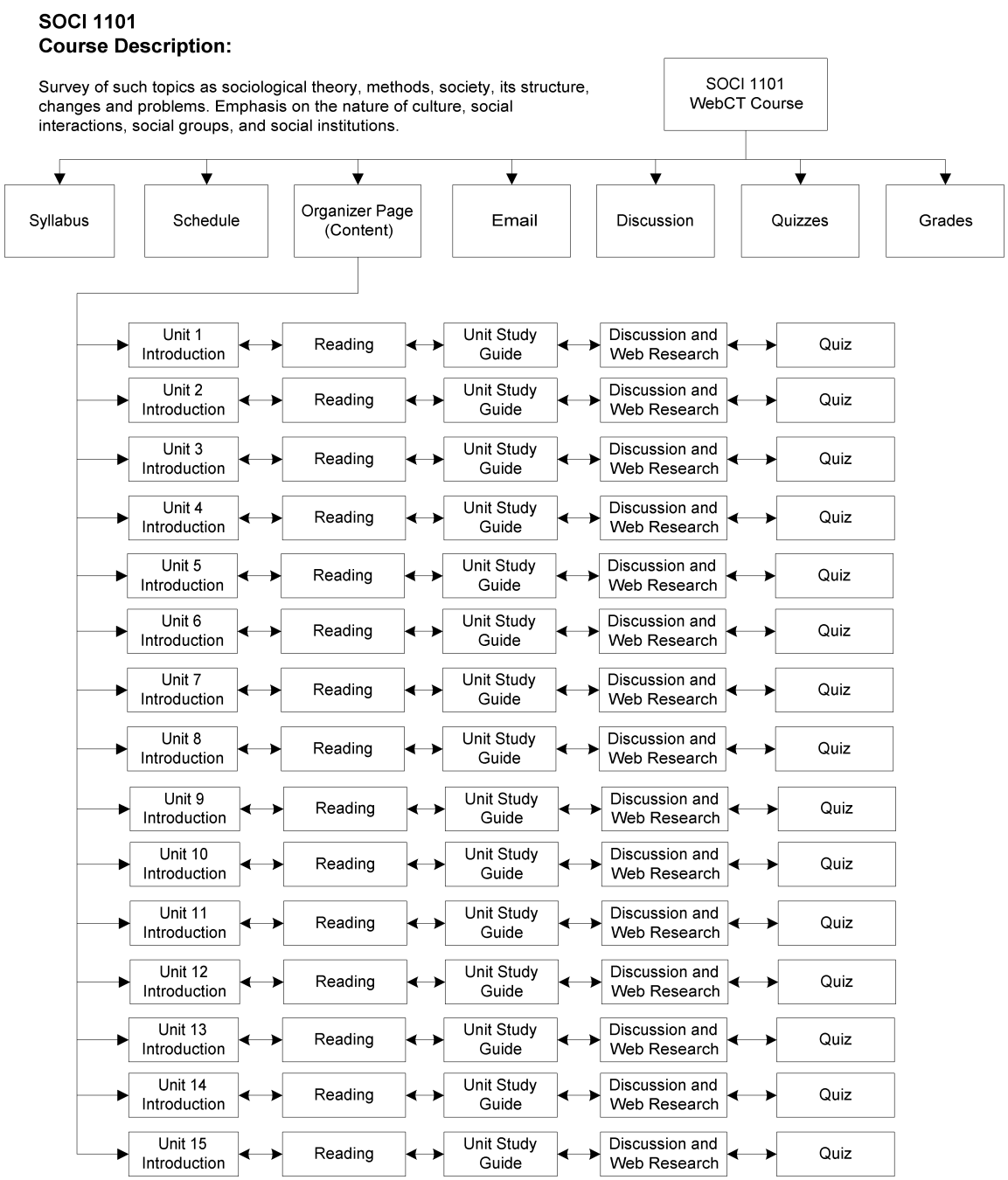


Figure 6. SOCI 1101 Flowchart



WebCT tools. WebCT is a powerful Learning Management System with many ready-made, highly functional "Tools". These subprograms are designed to facilitate the delivery, assessment, and management of Web Based Instruction (WBI) while at the same time making programming and course setup within the grasp of most educators. Each course designed for this project utilized the email, discussion, grades, and quiz tools. The calendar tool was used only in ARTS 1100 while ENGR 2502 and SOCI 1101 utilized the single page tool in order to display single HTML pages for the course schedule of events. Single HTML pages were also used for the syllabi for each class due to disappointing past experiences with the WebCT syllabus tool. None of the three project courses included synchronous instruction so the chat and whiteboard tools were not included. Email attachments were used as the primary method of assignment turn-in to avoid cumbersome aspects of the assignment tools drop box.

Units for each course were designed in a sequential manner. Content and assignments within each course flowed one to another in stepwise succession to guide the learner to achieving each unit's behavioral and cognitive objectives. This made the creation of individual web pages necessary and was extremely helpful with the creation of the aesthetic aspects of the environment. Despite WebCT's power as an LMS there are relatively few options for creating an aesthetic visual environment within the interface. The color and contrast of basic interface elements were manipulated from the "Customize Course Appearance" menu under the "Change Settings" link available to course designers. At best, this allows for selection of colors to enhance the interface. Additionally, there are very limited layout styles available. These limitations of WebCT

made the dependence on single HTML pages the most powerful "tool" in the creation of the aesthetic environments.

Guidelines for Aesthetic Treatments

Background of aesthetics. Eisner (1982) states that aesthetics is distinct from art in that art generally implies making something. Aesthetics, on the other hand, is related to "the experience secured from things already made… 'aesthetic' is more closely associated with the experience or appreciation of such form" (Martin, 1986). This definition helps distinguish aesthetics from art in its pure form. Art is something tangible and enduring. "Aesthetic" is generally thought of as an emotional response produced by a work of art or an artistic looking (or sounding) environment or event. Both the Webster's Dictionary and the American Heritage Dictionary define aesthetic as "concerning or characterized by an appreciation of beauty or good taste." These distinctions and definitions between art and aesthetics help generate an understanding that aesthetics is a subjective condition. In the case of online learning the determination of the aesthetic quality of a visual environment rests primarily with the student. If the student finds the environment pleasing and engaging (a positive emotional response) then the visual elements have combined in a manner considered to be aesthetic by the user. When thinking of aesthetics in regards to instructional motivation it is only the positive emotional responses from visual presentations that will be considered in this project.

Much has been written about aesthetics particularly in regards to education; however, much of this literature is concerned with the *education of aesthetics* rather than the application and benefits of *aesthetics in education*. Though there has been a lack of

research that identifies the effects of aesthetics on motivation and learning outcomes, studies have shown a preference among distance learning students for the visual elements that help make up aesthetic treatments. These visual elements include the use of color and graphics (Hathaway, 1984). Usability research on the use of these elements is not specifically concerned with applying them in an *aesthetic* manner but in an *effective* manner; therefore, any distance-learning environment must be appropriately designed to allow ease of use and clarity of presentation in addition to producing a positive emotional response.

Instructional designers should be aware that careful use of visual elements may enhance aesthetic appreciation but does not do so automatically. The quality and composition of the visual elements directly influence the aesthetic quality of any instructional piece. There is no exact formula or procedure for creating a visually aesthetic environment; however, it is useful to study what research has discovered about the use of individual visual elements and design practices derived from the visual arts. To aid instructional designers in making these decisions, research and industry practitioners suggest specific strategies that can be incorporated in any instructional media presentation to present visuals and other content that may add substantially to a learner's aesthetic awareness (Martin, 1986). For the purposes of this project, recommendations have been taken from Barbara Martin, Robin Williams, and Jakob Nielsen. Martin's strategies are taken from her awareness of research findings and personal experience as an ID. Williams is a recognized expert in screen and graphic design. Nielsen's criteria are drawn from extensive usability studies.

Guidelines - Barbara Martin. In her 1986 article, "Aesthetics and Media: Implications for the Design of Instruction," Barbara Martin suggests that aesthetic concepts should be incorporated whenever possible into all instructional content. She makes the assumption that:

> *"Aesthetically sound productions can serve multiple functions; they can enhance aesthetic awareness and they can actually increase cognitive learning as well, since, in essence, aesthetically sound productions are better productions. They capture and hold the attention of the learner longer, thus focusing the learner's attention on the content of the production."*

Martin (1986) makes both general and specific suggestions for incorporating aesthetics into instructional media. While many of these strategies are directed toward the inclusion of aesthetic understanding in the education of instructional designers, there are useful concepts that may be garnered for applying aesthetic treatments to distance learning media.

1. Keep in mind the developmental level of learners and their previous experience with aesthetics.
2. Strive to include visuals that invoke and serve as a catalyst for emotional and feeling responses.
3. Use great works of art whenever possible to illustrate ideas and concepts that are being taught and to enhance aesthetic development.

4. Make the best use of color and use it often. Even when color is not essential for cognitive understanding, use it to enhance aesthetic appreciation (DeGarmo, 1913).

Guidelines - Robin Williams. Robin Williams' suggestions are very general but are easy to apply to specific instances. She breaks the entire concept of visual design down into four basic principles – Contrast, Repetition, Alignment, and Proximity. Each principle may be applied to any visual element (type, color, size, line thickness, shape, space, etc.) and is usually used in conjunction with the other principles.

1. Contrast – If elements on a page are different, make them very different. She considers contrast the most important visual attraction on a page.
2. Repetition – Repeating the use of visual elements throughout a piece enhances unity and organization.
3. Alignment – "Nothing should be placed on the page arbitrarily. Every element should have some visual connection with another element on the page" (Williams, 1994).
4. Proximity – Items that relate to each other should be grouped close together to make them one visual unit. This helps organize the page visually.

Williams explains these four principles in detail in her text *The Non-Designers Design Book*. This is a short, easy-to-read book about design and typographic concepts.

Clear examples help bring understanding to each of the four principles in a manner that allow readers to develop their own set of "do's and don'ts".

Guidelines - Jakob Nielsen. Jakob Nielsen's focus is on usability. His suggestions are basically a series of do's and don'ts to consider when creating web pages that can be functional and easy to use. Although his criteria for an appropriate web page do not focus on the creation of an aesthetic environment, the aesthetic presentation should not be detrimental to the learning experience. Therefore, all visual elements must be functionally efficient as well as aesthetically effective. Pages should load quickly, pictures and graphics should not be distracting, and visual elements should not interfere with a learner's access to course content.

When selecting which criteria of Nielsen's to use, careful attention was given to the reasons why the suggestions were made. When he says, "Gratuitous graphics simply have to go including all instances of text rendered as images (Nielsen, 2000)", Nielsen is considering the negative impact these images have on download time not the negative impact the absence of these images will have on the user's experience. The list of criteria taken from Nielson was selected to accommodate the "why" more than the "rule".

1) Download times should not exceed 10 seconds.
    a. File size should be kept to between 34k and 50k.
    b. Graphics should be optimized for the web by reducing their scale, cropping, and setting resolutions for computer screens (i.e. 72 dpi – 96 dpi)

2) Use of metaphor can be useful by creating a unifying framework instead of a series of unrelated pages.
3) Color should be used but not in a manner that is distracting to the primary content.
4) Background images should not interfere with text.

Summary of aesthetic criteria. The previous lists from Martin, Williams, and Nielsen are a combination of rules, guidelines, and design concepts; however, lists are not exhaustive. Each of these designer's original lists are considerably longer than the selected points presented here. When used together in an effective manner, the presented selected criteria above will enable faculty and course designers to increase the odds that an effective aesthetic environment will be produced. These criteria were applied to each of the three courses in this study to create the visual aspect of the learning environment.

Student Perseverance and Aesthetic Environments

The primary goal of all educational courses is to increase the learner's knowledge and understanding of course related concepts, not to create an aesthetic environment in which to learn. A wide variety of methods and procedures have been employed to raise the effectiveness of instructional delivery. One approach has been to increase learner motivation (Small, 1997). This concept suggests that learning will increase if students have an increased desire to learn.

The Carroll Model and Implications for Increasing Student Motivation

The concept of student motivation figures strongly within John Carroll's Model of School Learning. Carroll puts forth the concept of student perseverance as an influential variable as it relates to a student's aptitude, opportunity to learn, and the quality of instruction. He defines perseverance as the amount of time a student is willing to spend engaged in learning. In essence, students' perseverance is their motivation to learn.

Perseverance figures into the model of school learning with a direct correlation to student achievement. As time spent learning (perseverance) increases, student achievement increases to the extent that it does not exceed the time required by that student to learn the concept (Carroll, 1963 & 1989). If a student has a high aptitude for a subject, but does not spend the necessary amount of time engaged in the learning process or is not given enough time to learn the concept, then that student will not reach his or her highest level of achievement. On the other hand, if a student has a low aptitude, is given the necessary opportunity to learn and has a high level of perseverance (motivation) to remain engaged with the content, then a higher level of achievement can be expected. It is essential that student motivation is sufficient to take full advantage of available time to interact with course material. Since course content is made available for very large blocks of time when delivered by asynchronous distance education the object is to motivate the individual learner to spend the required time for high achievement.

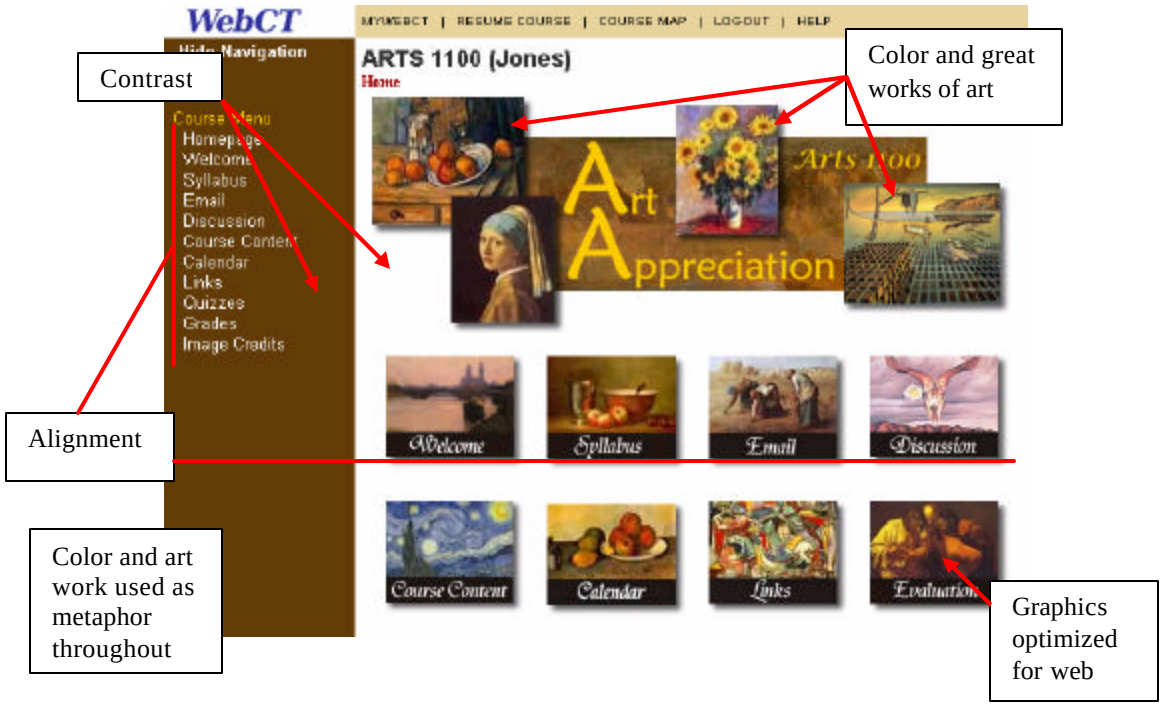
The inclusion of aesthetics in education is generally accepted throughout the academic community. Their influence on student motivation could prove to be an important factor in increasing student contact time with course content. This project was

designed in a manner that would allow a comparison of student preferences over the satisfaction they experience when interacting in an aesthetic or non-aesthetic environment. Accommodations were also made to track the student time spent within these contrasting environments in order to study possible effects of aesthetics on student perseverance.

Design for Evaluation of Aesthetic Effects

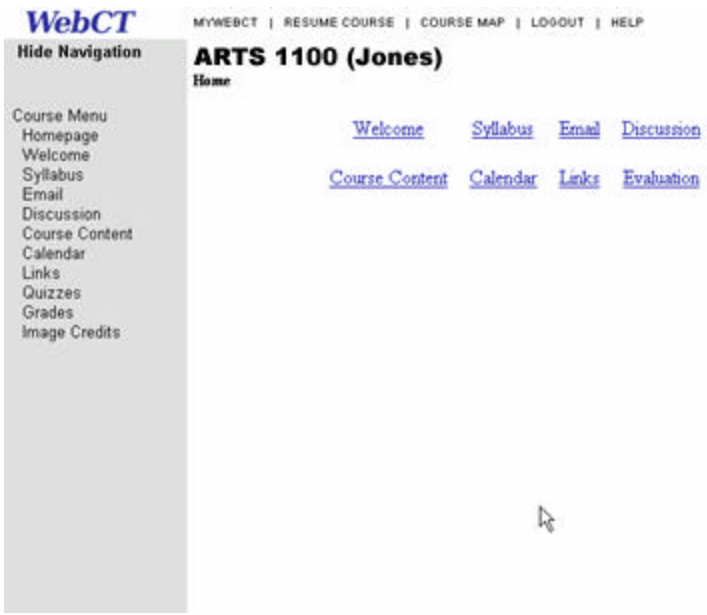
Two learning environments were created for each course in order to explore the effects of aesthetics on student motivation and satisfaction -- a control and experimental group. The experimental classes applied the suggestions for the creation of aesthetic visual environments from Martin, Williams, and Nielsen. The control groups were void of aesthetic treatments. The control and experimental sections were aesthetically distinct from one another but contained the same instructional content. Students in the experimental group experienced the course with colorful images, scripted text, and interesting layout. Use of some of the suggested aesthetic guidelines can be seen on the homepage of the experimental section of Art Appreciation – ARTS 1100 (Figure 7).

Figure 7. Sample Page of Aesthetic Treatment



The control group experienced the same content without the benefit of the aesthetic elements (Figure 8). Care was taken to avoid making the environment of the control group purposely displeasing. The goal, as stated earlier, was to make the presentation void of the visual elements normally associated with aesthetic online learning environments, not to create an environment that produced a negative emotional response.

Figure 8. Sample Page of Non-Aesthetic Treatment



It is important to remember that this project defines aesthetics as an emotional response produced by visual elements in a learning environment. Since emotional responses can be positive or negative the incorporation of aesthetic elements into this project's media attempted to produce an environment that was pleasing and engaging to the learner in an attempt to increase student interest in the course.

Preparation for Human Participant Research

Though this project was not a pure research study, the design for the evaluation of aesthetic effects did plan on collecting data on human subjects. This necessitated the completion of the training required for human research. The ID completed the *Human Participants Protection Education for Research Teams* certification and proceeded with an application to the University of South Florida Institutional Research Board. It was

believed that the project met the requirements for an exemption from informed consent. The following are two of the six exemption criteria stated in section 45 CFR 46.101(b) of the federal guidelines.

1. Research conducted in established or commonly accepted educational settings, involving normal educational practices
2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless:
    a. Information obtained is recorded in such a manner that human participants can be identified, directly or through identifiers linked to them.
    b. Any disclosure of the human participant's responses outside the research could reasonably place the participant at risk of criminal or civil liability or be damaging to the participant's financial standing, employability, or reputation.

Both learning environments created in this project fall within "commonly accepted educational settings" as required in criteria #1. In regard to #2, the project did observe student behavior. However, the behavior was not "public" and would not be recorded in a manner that could be linked with specific participants. Additionally, no disclosures of individual participant's responses were to be made. The University's Institutional Review Board agreed with this assessment and issued an exemption certificate (No. 101579) for the project.

Developmental Needs Resulting from Design

In order to evaluate the effects of the two types of aesthetic treatments student satisfaction would need to be accessed and compared between the control and experimental groups. Middle Georgia College already collected detailed student opinions of the online experience through a Student Opinion Survey of the Learning Environment (SOSLE). This survey had proven useful in the past as a measure of the student's satisfaction with various elements of the course, including the orientation, communication, academic rigor, and usefulness of the individual tools in WebCT. In order to gather additional information about the student's satisfaction with the visual elements of the environment the following two statements were added to the survey:

1) The course appearance was attractive.

2) The course appearance made me want to visit the website.

Both statements were based on a 5 point Likert scale with the choices of Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1), and Not Applicable (0).

Development

Implementation of Design

Once the Design phase of course creation was completed, it was necessary to apply the design within the development process. During the development of the project courses, close attention was paid to each of the recommendations for the use of visual elements in order to produce an aesthetic environment to be used for the experimental group and a non-aesthetic environment to be used for the control group.

Programming for evaluation of aesthetic effects. In order to study the effects of aesthetic treatments on the control or experimental groups, it was necessary to track each student's time spent on each page of content. Exhaustive investigation for an "off the shelf" programming solution proved futile. The only solutions found required the use of computers with bi-directional communication, i.e. both the server and client continuously update each other on their status. The Internet is currently mono-directional with the information needed to track time variables found only on servers. At this point, examining the effects of aesthetic environments on a student's motivation could have been dropped as a project goal. However, careful consideration reaffirmed the importance to study this relationship in an attempt to support the need for aesthetic learning environments in addition to exploring the guidelines necessary for their creation.

Several solutions were explored. The ability to track time variables was found in Java (programming language) and Actionscript (a scripting language similar to Javascript based on ECMAScript). The use of Java Applets embedded in each page could be used to

record when the page loaded and when the page closed. More importantly, Java has the ability to record the data to a database through Open DataBase Connectivity (ODBC). Unfortunately, this solution required advanced programming skills and the creation of a unique Java Applet for each page of content. A similar solution involved using actionscript in conjunction with the Macromedia Flash Communication Server, which is capable of limited bi-directional communication between the client and server. While attempts to display the data were successful, recording it to a database proved beyond the programmer's ability.

A viable solution was finally found using Coldfusion MX and basic browser functionality. Coldfusion code is written into HTML pages in a similar manner to Javascript and is run only when a page loads. This required code being written in each content page to record to the server when the page loaded into the client's (students) browser. In addition to the time, the name of the page loaded, the page name, and the student's IP address were instantiated as Session Variables. When the page was closed an onUnLoad browser event was used to call a "logger page". The logger page was passed the session variables. These were utilized to compare the student's IP address and time of loading with that already recorded in the database so the time the page was unloaded could be written to the correct database record. Once in the database simple math was used to subtract the timeIn record (time page loaded) from the timeOut variable (time page unloaded). The number of seconds spent on the page was then recorded into another field in the record. While this was a rather complicated procedure, tests showed it to be

reliable with any browser, operating system, and platform as well as requiring no additional plug-ins.

The design requirements needed to implement an examination of the effects of aesthetic environments required significant changes in the page structures of each course. All of the pages containing content essential to the understanding of subject matter were removed from the WebCT directory and placed on a freestanding web server. The code needed for time tracking was added to each content page, the logger pages were created, and a database for each class was set up and linked to the Coldfusion Administrator running on the same Apache web server as the course content pages. Additionally, the organization of content had to be simplified to make variable tracking easier. This was done only after it was determined that these changes would have no negative effect on the presentation of course content. The original sequential multi-page design was abandoned in favor of single unit pages. Unit content, activities, and assessments remained sequential but on a scrollable page instead of multiple single pages. Supporting information (guidelines, study guides, example pages, and expanded information pages) remained as separate pages. New, more detailed flowcharts were created to facilitate the order and programming of a sophisticated process of content display, variable instantiation and data recording (Figures 9, 10 and 11). This process took place utilizing the resources of three different web servers. To be considered successful it was essential for the exchange between basic page (course content) display and data collection to be done completely within the WebCT interface in a manner that was not distracting or intrusive to the student's learning experience.

Figure 9. ENGR 2502 Flowchart (Revised)

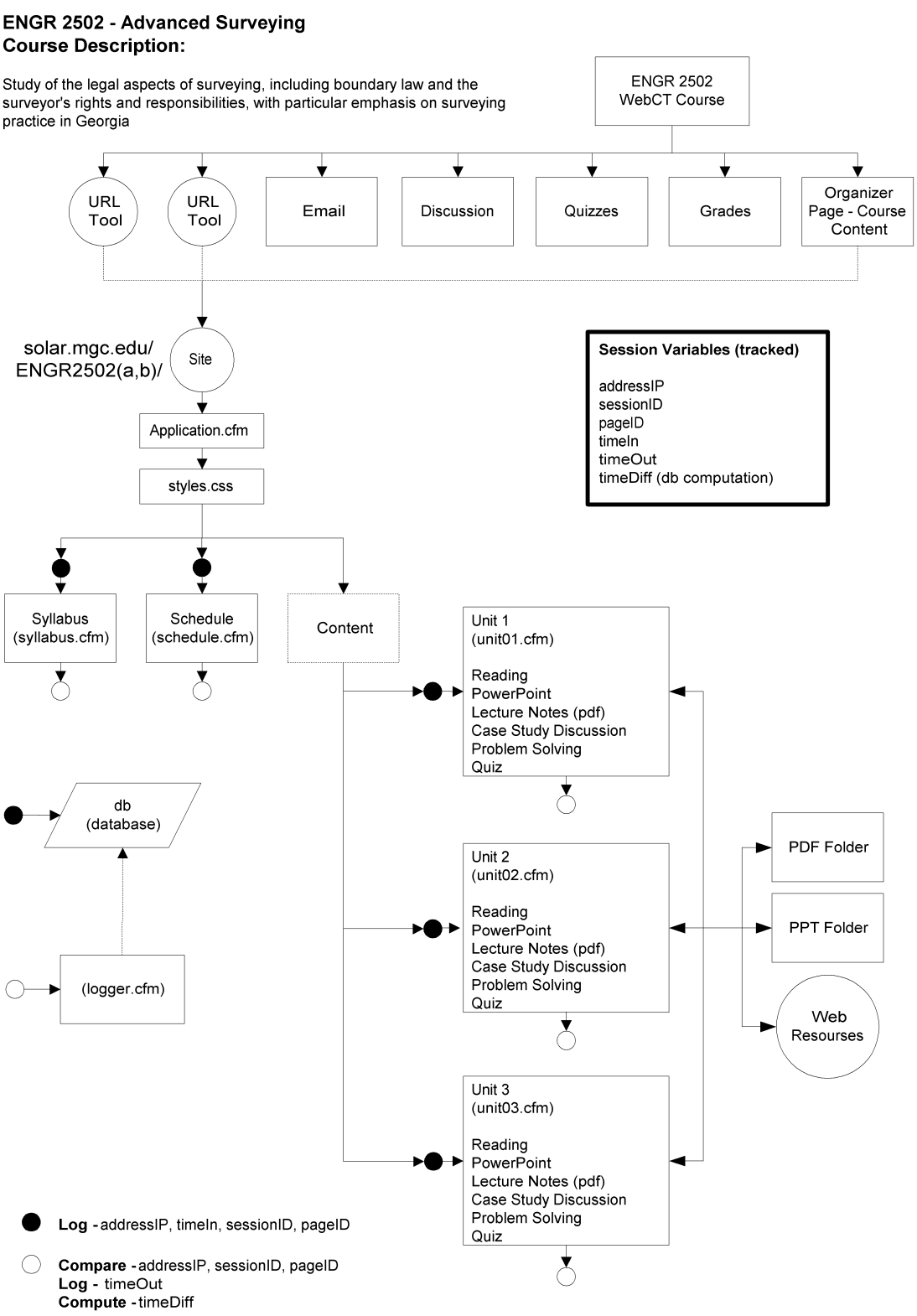


Figure 10. ARTS 1100 Flowchart (Revised)

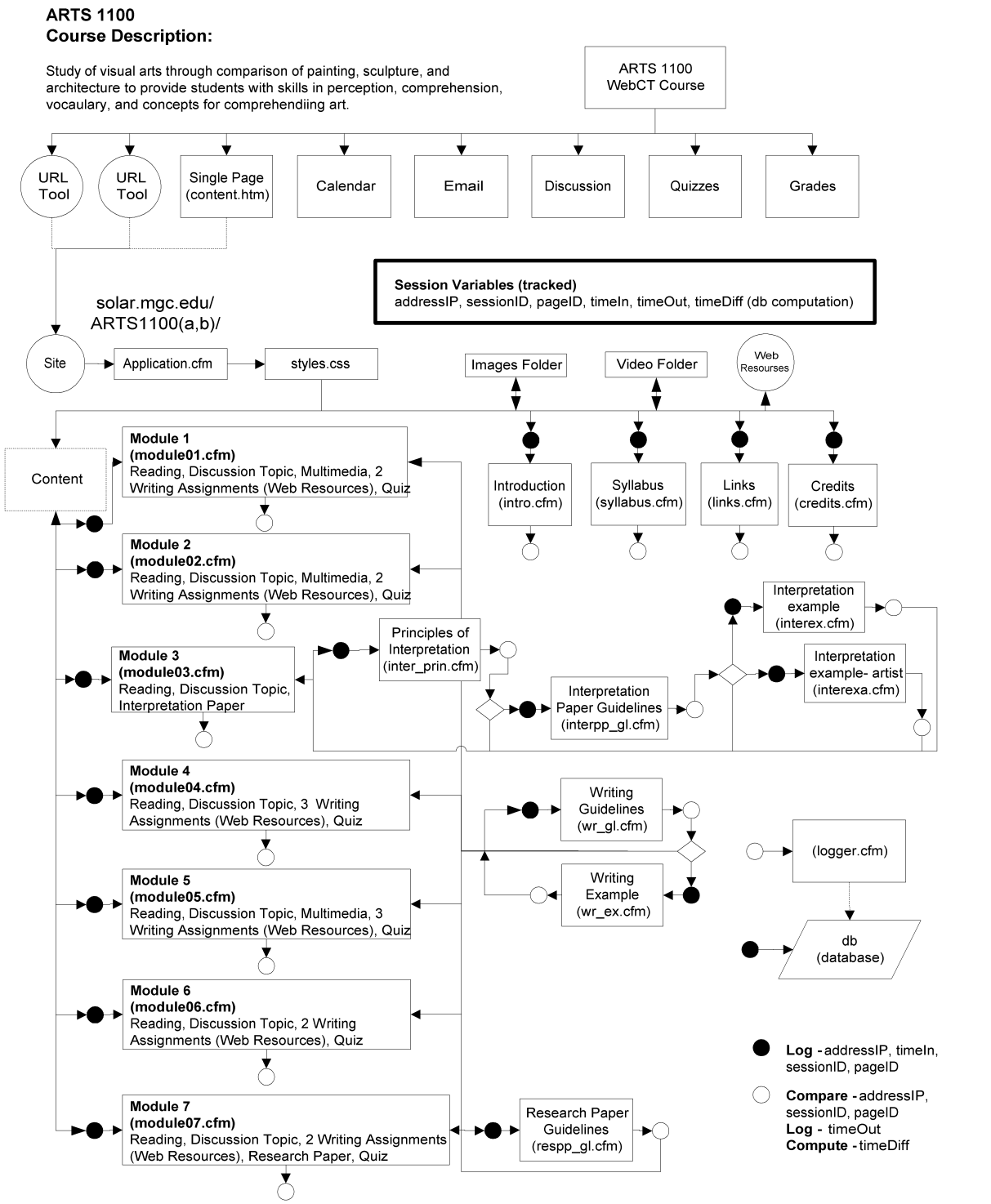
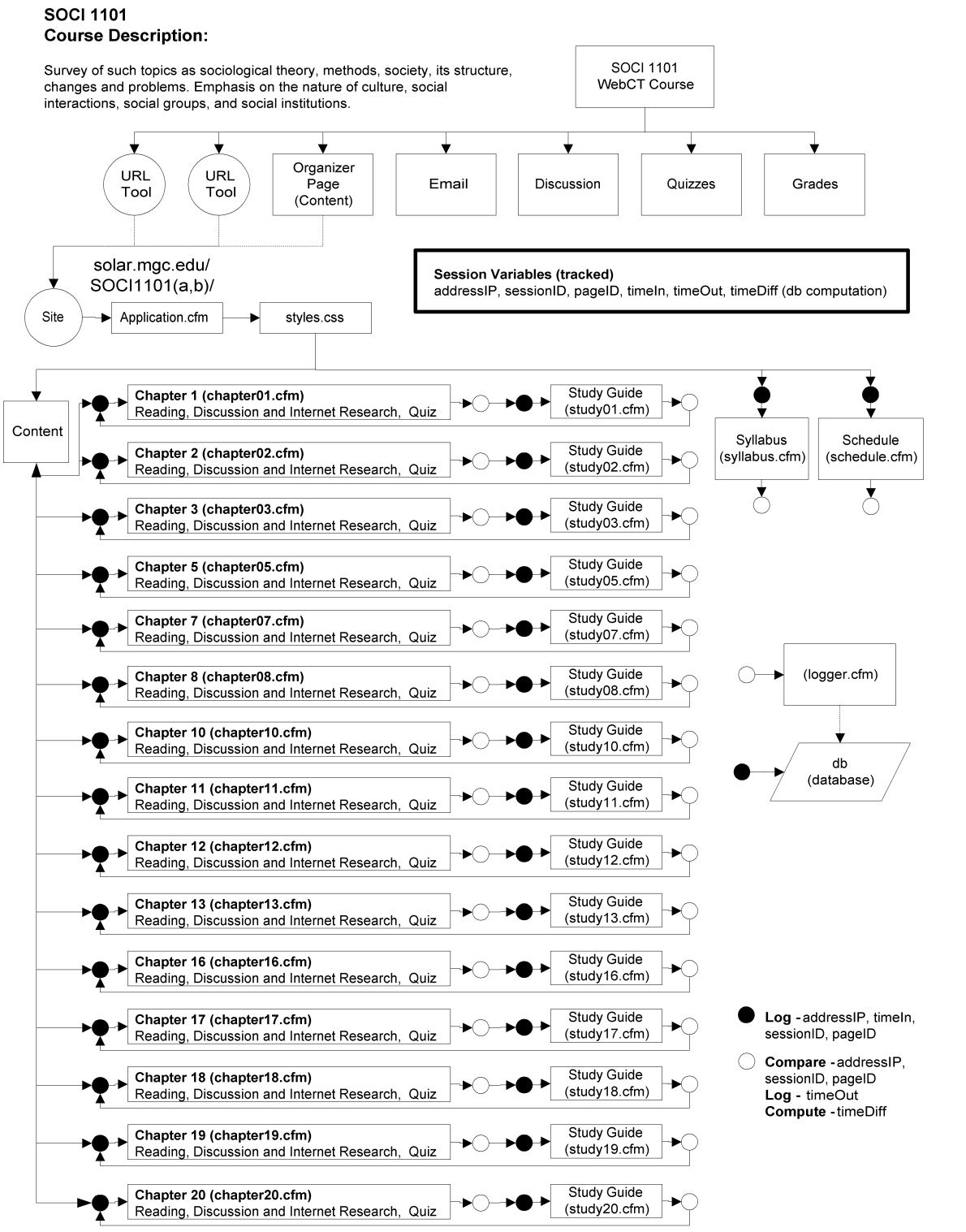


Figure 11. SOCI 1101 Flowchart (Revised)



Methods of development. Once the course structures were finalized, the development of the academic content of each course became the next priority. Content for each course unit was assembled and formatted into HTML pages using Macromedia Dreamweaver MX and placed on an Apache server in two separate web sites for each class. Sites ending with "a" would hold the content for the control group and the sites ending with "b" would contain the content for the experimental group. In addition to unit content, HTML pages for course syllabi, schedules, and guidelines for projects and assignments were also developed and copies placed in both the control and experimental sites.

Once development of content was complete the guidelines for the creation of aesthetic environments were applied to the experimental site's pages. Each use of color, graphics, and layout was decided upon with the project's aesthetic criteria in mind and then scrutinized again to insure that successful implementation of one criteria did not compromise another. The following series of screen shots (Figure 12 – 16) compares the aesthetic treatment of the experimental group (left) with the non-aesthetic treatment for the control group (right).

Figure 12. ARTS 1100 Welcome Page

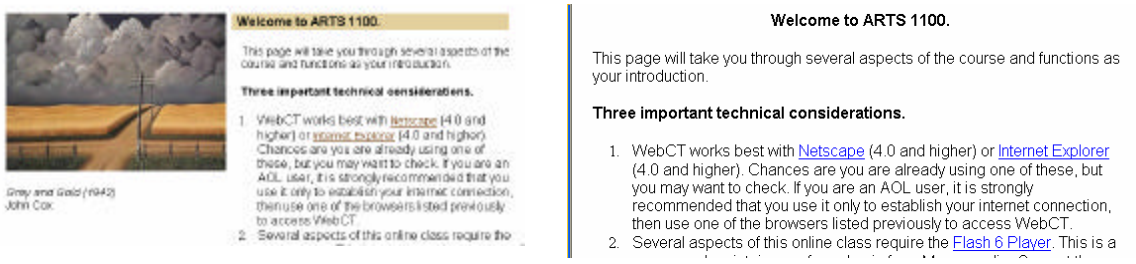


Figure 13. ARTS 1100 Module 1 Content Page

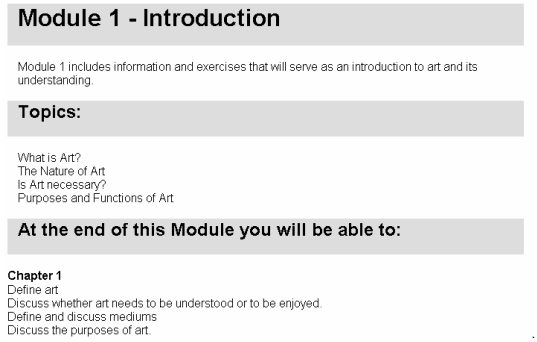


Figure 14. ARTS 1100 Course Content Menu Page

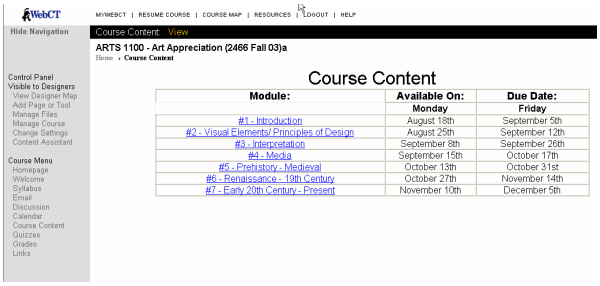
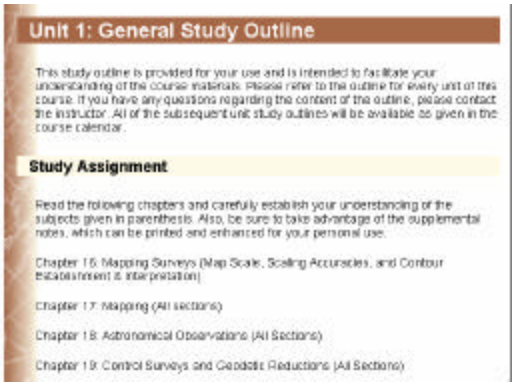


Figure 15. ENGR 2502 Unit 1 Content Page



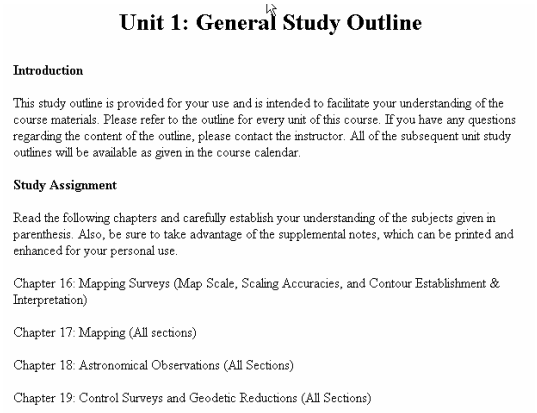
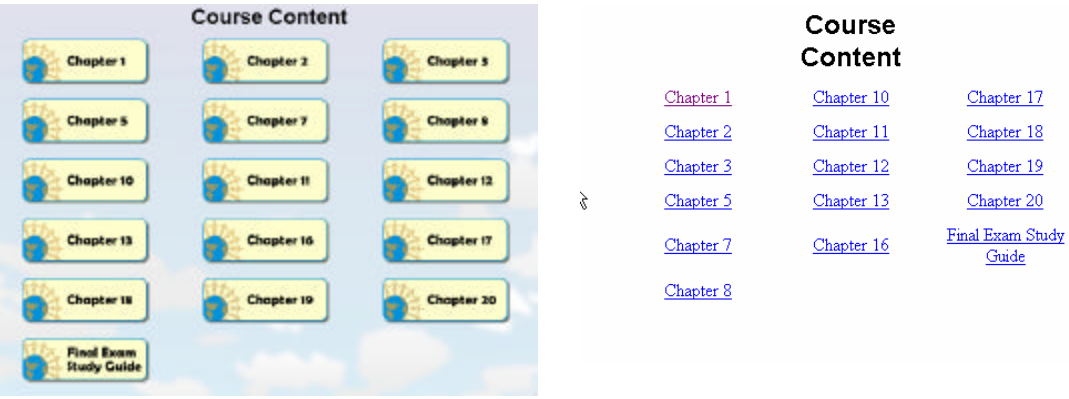


Figure 16. SOCI 1101 Course Content Menu Page



Links were created in WebCT to the content pages using the URL Tool. Content pages for WebCT courses are usually uploaded to the WebCT server but to implement this project's plan to study the effects of the aesthetic treatments it was necessary to keep the content pages on a local server where data could be more easily recorded in a database.

Communications, assessment, and record tools were not considered to be course content. The standard tools within WebCT were utilized for email, discussion, online quizzes, and student grades. Email in each class was used strictly for basic communication, questions, and assignment turn-in. Course quizzes assessed student comprehension of the subject matter, but did not *deliver* content. The grades tool functioned only to inform students of their progress and current scores. An argument can be made that the discussion boards did deliver content. Both students and faculty posted opinions, solutions, and resources that extended the understanding and interaction with the subject matter. However, developing a custom discussion application with the power

of the WebCT discussion tool was beyond the programming skills of the ID and scope of this project.

Deployment and testing. The first test of the time tracking programming was with only one course. When set up and tested as a free standing website, all time tracking data proved to be recorded reliably and accurately. However, when loaded to run in the course sites within the WebCT interface for the second test only the time of page loading was recorded. WebCT utilizes HTML frames to display its pages. Examination of the problem revealed that the programming for frames interfered with the calling of the logger page. This necessitated a minor design change that loaded each content page in its own pop-up window. The wide spread use of "pop-up killers"-- browser applications that prevent the opening of pop-up windows -- was not a factor since WebCT already required this browser functionality for quizzes to run correctly.

A third test showed all time tracking protocols worked as planned but revealed the need to add several other additional features. OnFocus and OnBlur HTML events were added to the pop-up windows to prevent the students from losing track of the content window and a millisecond timeout and self closing Javascript was added to the pop-up logger window to open and close it in the least intrusive manner. The beta test included testing with Internet Explorer, Netscape, AOL, Earthlink and Opera browsers, PC and Macintosh platforms, and Windows 95, 98, 2000, XP, OS 9, and OS X. This extensive beta test with campus technology staff showed no additional problems with the architecture or coding.

Creation of the student opinion survey of the learning environment (SOSLE).

Once the courses were programmed and tested, the Student Opinion Survey of the Learning Environment (SOSLE) was reprogrammed with the two additional survey questions pertaining to the environment aesthetics. All questions used to evaluate the student's satisfaction with the course and opinion of the environment were based on a Likert Scale with the choices of Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1), and Not Applicable (0). All students in the control and experimental groups were asked to participate in the SOSLE. Comparing the recorded IP address of the survey with the IP addresses collected in the time tracking data separated results for the two groups. Though IP addresses for the students were not static (unchanging), duplicate addresses were recorded in the survey and time tracking databases due to the fact that IP addresses are only changed after eight inactive days of network access.

Implementation

Implementation of the project courses was done in conjunction with the Middle Georgia College Fall 2003 Semester. Only one section of each course was scheduled so arrangements were made with school administration and course instructors to divide the single section into two groups. Once registration was complete, students were randomly selected for assignment to the control or experimental groups. Random assignments were continued through the drop add process in an attempt to keep both groups as equal in number as possible (Table 3).

Table 3 Course Enrollment and Group Division

Course Enrollment and Group Division

	Control Group	Experimental Group	Class Totals
ARTS 1100	14	16	30
ENGR 2501	21	22	43
SOCI 1101	13	13	26
Group Totals	48	51	99

No technical problems were encountered during the semester. The servers remained up continuously. Data collection was monitored on a regular basis. The survey of the student's opinions was conducted during week 14 of a 15 week semester.

Evaluation

Assessment of the Aesthetic Environments

As previously stated, the presence of aesthetics is subjective. The criteria selected by this project for the creation of the experimental learning environments only improve the chances that an aesthetic course appearance was achieved. Aesthetic content is a matter of personal opinion and degree, not an "On/Off" condition. However, in an effort to find some gauge to assess whether the application of the selected criteria for the creation of aesthetics was successful in this project, an informal opportunity was created to obtain the opinions of potential users. This data collection was necessary because it afforded the opportunity for the users to make a comparison between the aesthetic and non-aesthetic environments unlike the students taking the classes who were only exposed to one of the two environments.

Over a four-month period content pages from the control and experimental courses were shown to 13 faculty and 10 students. The experimental (aesthetic) treatment was shown first and their opinion asked. The strength of responses varied but all could be considered to be an affirmation that some degree of visual satisfaction was experienced. This opinion was strengthened when a comparison was made to the control (non-aesthetic) treatment. The strongest preference was for the experimental treatment of ARTS 1100 that incorporated Martin's criteria of including "great works of art when appropriate".

Table 4 Student Opinion Survey Analysis – Group A

Student Opinion Survey Analysis – Group A

	Question	SA	A	D	SD
1.	I kept up with assignments and study for this course.	50(8)[1]	44(7)	6(1)	
2.	I completed and submitted all course assignments by deadlines.	56(9)	31(5)	13(2)	
3.	The instructor encouraged me to think for myself.	63(10)	37(6)		
4.	This course challenged me to learn.	56(9)	37(6)	6(1)	
5.	I have learned very much about this subject from this course.	56(9)	44(7)		
6.	I learned useful skills from this course.	50(8)	50(8)		
7.	The course appearance was attractive.	44(7)	56(9)		
8.	The course appearance made me want to visit the website.	37(6)	44(7)	13(2)	
		A	B	C	D
9.	What is your expected grade in the online course you are evaluating?	56(9)	31(5)	13(2)	
		Yes	No		
10.	Would you enroll in another online course from MGC?	94(15)	6(1)		
		<5	5-10	11-20	20>
11.	Hours per week you spent on the course you are evaluating?	25(4)	50(8)	19(3)	6(1)

Table 5 Student Opinion Survey Analysis – Group B

Student Opinion Survey Analysis – Group B

	Question	SA	A	D	SD
1.	I kept up with assignments and study for this course.	88(14)	12(2)		
2.	I completed and submitted all course assignments by deadlines.	88(14)		12(2)	
3.	The instructor encouraged me to think for myself.	94(15)	6(1)		
4.	This course challenged me to learn.	94(15)	6(1)		
5.	I have learned very much about this subject from this course.	94(15)	6(1)		
6.	I learned useful skills from this course.	88(14)	12(2)		
7.	The course appearance was attractive.	81(13)	19(3)		
8.	The course appearance made me want to visit the website.	81(13)	12(2)		
		A	B	C	D
9.	What is your expected grade in the online course you are evaluating?	75(12)	25(4)		
		Yes	No		
10.	Would you enroll in another online course from MGC?	100(16)			
		<5	5-10	11-20	20>
11.	Hours per week you spent on the course you are evaluating?	50(8)	44(7)	6(1)	

Table 6 Tabulated Averages of Related Survey Questions

Tabulated Averages of Related Survey Questions

Questions	Control Group (A)				Experimental Group (B)			
1. I kept up with assignments and studying for this course.	3.44				3.88			
2. I completed and submitted all course assignments by deadlines.	3.44				3.75			
3. The instructor encouraged me to think for myself.	3.63				3.94			
4. This course challenged me to learn.	3.5				3.94			
5. I have learned very much about this subject from this course.	3.56				3.94			
6. I learned useful skills from this course.	3.75				3.88			
7. The course appearance was attractive.	3.44				3.81			
8. The course appearance made me want to visit the website.	3.27				3.87			
9. What is your expected grade in the online course you are evaluating?	3.44 GPA				3.75 GPA			
10. Would you enroll in another online course from MGC?	Yes (1 No)				Yes			
11. Hours per week you spend on the course you are evaluating?	<5	5-10	11-20	>20	<5	5-10	11-20	>20
	4	8	3	1	8	7	1	

The SOSLE is based on a Likert scale. Answers are weighted, added, and then averaged. This procedure produces a number that represents the strength of the group's

opinion. Of the 99 students taking one of the three courses, 32 completed the Student Opinion Survey of the Learning Experience. While these numbers were lower than desired they are high enough to identify the tendencies in the student's opinions and level of satisfaction. In the case of the two contrasting environments there is a modest but definite higher level of satisfaction with the course appearance from those in the experimental groups. Nearly twice as many students answered that they "Strongly Agreed" that the course was attractive (13 to 7) with the point average for the experimental group being 3.81 compared with the average for the control group being 3.27. The difference between the two increases when asked if the appearance made them want to visit the website with the averages for groups A and B being 3.27 and 3.87 respectively. It should also be noted that all the "Disagree" opinions for the two questions were from the control groups. These results support that students recognize and prefer an attractive learning environment. However, the relatively high score for the control group would seem to indicate that although satisfaction with an aesthetically pleasing environment is higher, students do not completely object to an environment void of visual enhancements if not given a choice between the two. Tables 4 & 5 display the raw data from the SOSLE.

Table 6 presents the tabulated averages of the other survey questions divided by group. These numbers suggest that the student's satisfaction with the courses extended beyond the appearance of the learning environment. In each instance, averages Percentage Distribution of Student Responses to the Unit Evaluation Form for the experimental group were higher. It would be relatively easy to claim the presence of an

aesthetic learning environment influenced these results; however, the sample size is too small to draw definitive conclusions on this matter and this type of analysis is not within the scope of this project.

Table 7 Summary of Time Related Data

Summary of Time Related Data

	Number of Seconds	Number of Minutes	Number of Hits	Total Number of Students	Ave. Min. p/Student	Ave. Hits p/Student	Ave. Minutes p/Hit
Control	99833	1663.9	1514	14	118.9	108.1	1.1
Experimental	103154	1719.2	1610	16	107.5	100.6	1.07
Class Totals	103154	3383.1	3124	30			
Control	60078	1001.3	1037	21	47.7	49.4	0.97
Experimental	94698	1578.3	1102	22	71.7	50.1	1.43
Class Totals	94698	1578.3	2139	43			
Control	62924	1048.7	921	13	80.7	70.8	1.14
Experimental	68896	1148.3	695	13	88.3	53.5	1.65
Class Totals	131820	2197	1616	26			
Project TOTALS	329672	7158.4	6879	99			

Two important pieces of data were collected through the design and development techniques for this project -- total number of page hits and total number of seconds spent on each page. When this data is analyzed with the number of students in each section,

interesting comparisons can be made between the control and experimental groups. The Average Minutes per Student (AMS) states the average number of minutes spent by each student working with online course content throughout the semester by converting the total number of seconds to minutes and dividing by the number of students in each section. The Average Hits per Student (AHS) divides the total number of page "hits" with the number of students in order to obtain the average number of times a student opened a course content page. The most important statistic divided the AMS by the AHS to produce the Average Minutes per Hit (AMH). The AMH reveals the average length of time each page of content was open. Table 7 summarizes the project time related data.

Several statistics are worth noting. In the ENGR 2502 course, the two groups of students had nearly identical numbers of hits (Figure 17). However, the average time spent by each student was 20% greater in the experimental (aesthetic) group. In SOCI 1101 students in the control group accessed course content pages an average of 15% more than the experimental group but the experimental group remained on the pages just under 20% longer.

Figure 17. ENGR 2502 Data

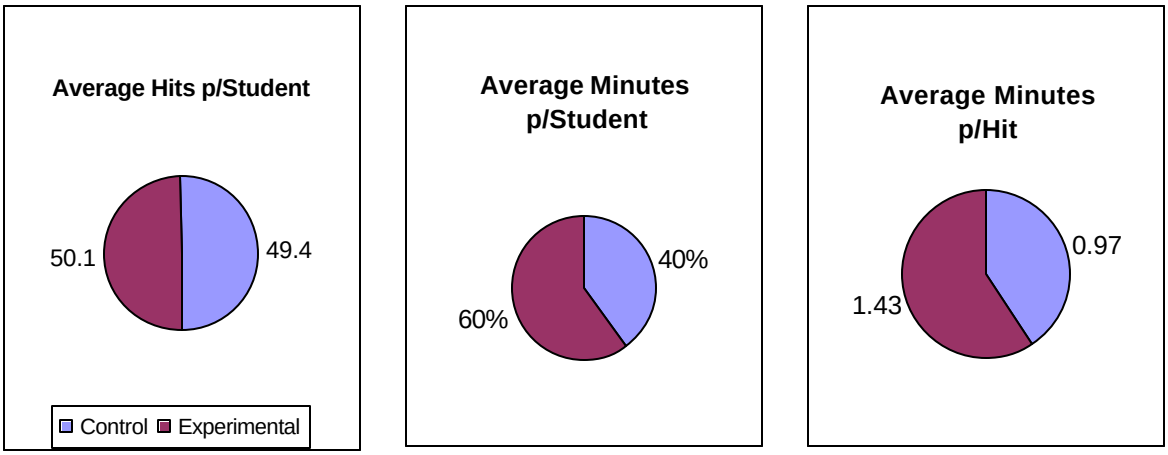
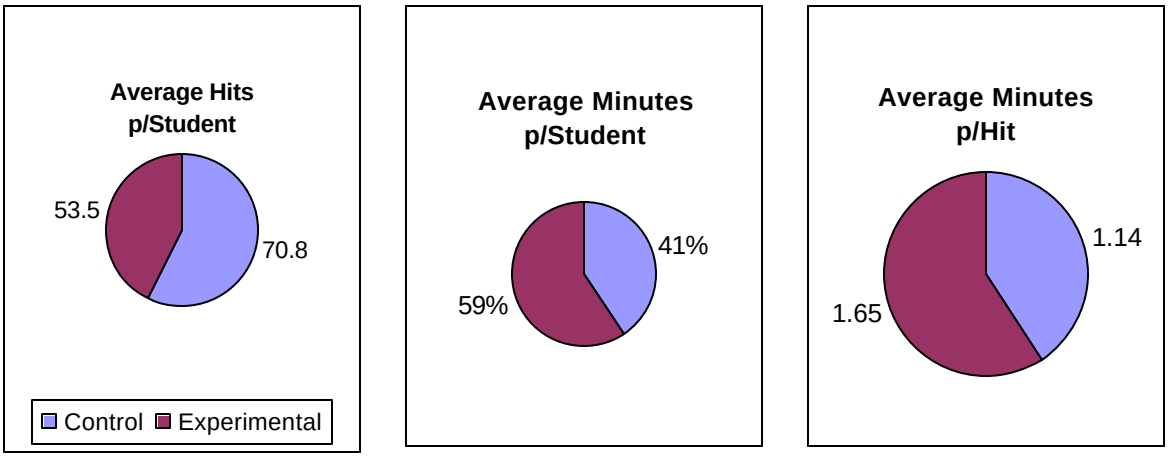


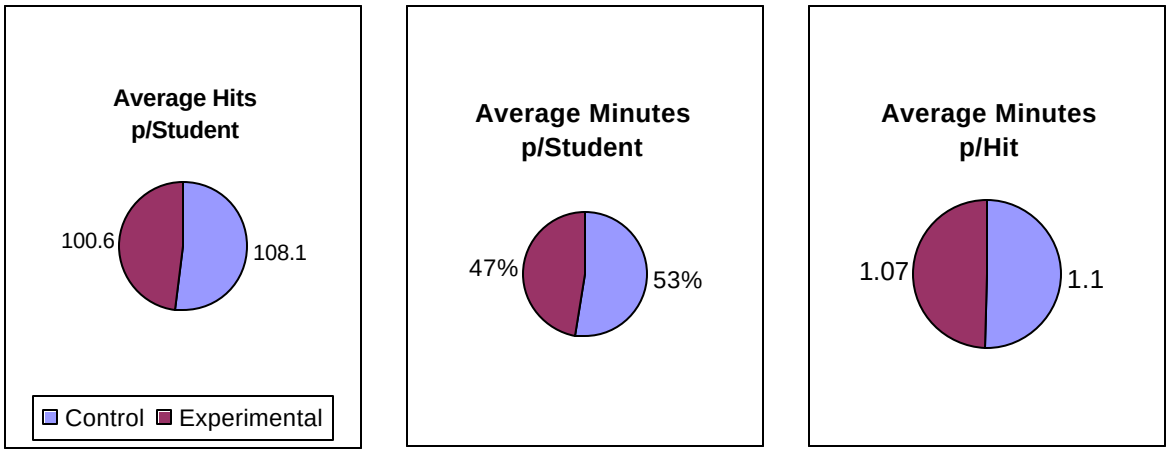
Figure 18. SOCI 1101 Data



While the results from ENGR 2502 and SOCI 1101 suggest the creation of an aesthetic learning environment has a positive result on student motivation, the recorded effects from the ARTS 1100 groups show virtually no effect (Figure 19). Students in the experimental group had a slightly lower number of hits and total number of minutes. When the AMH is calculated the average minutes per hit are 1.1 for the control and 1.07

for the experimental. The fact that the Instructional Designer considered the application of aesthetic criteria in the experimental group of this course to be the strongest of the three makes these results less supportive of the importance of the visual environment.

Figure 19. ARTS 1100 Data



Discussion of Evaluation

The primary goal of this project was to investigate guidelines and to create aesthetic visual environments in distance-learning media through the application of expert criteria and to explore the effects of those environments on student satisfaction and motivation. The application of the aesthetic guidelines produced courses that were visually pleasing. Though both the control and experimental courses received positive levels of satisfaction from students a stronger preference was recorded for the classes with the aesthetic treatment.

The effect of an aesthetic environment on student motivation was difficult to explore. A significant, though unintended, accomplishment of this project was the

successful tracking of student engagement data. The detailed tracking of each student's number of hits, the average number of minutes on each page, and the average number of minutes per hit allowed the effects of student perseverance to be explored. Comparisons between the control and experimental groups showed mixed results. Two of the courses, Advanced Surveying – ENGR 2502 and Introduction to Sociology – SOCI 1101, showed a definite increase in time spent by students in the aesthetic groups. In Art Appreciation – ARTS 1100 there was not a significant difference between the two student groups. It is important to point out that in the groups that showed a positive result from the application of the aesthetic criteria students spent more time on each page each time it was opened. Though the data is not conclusive it does suggest a modest correlation between the application of aesthetic criteria in the distance learning environment and student perseverance.

Conclusion

This project has demonstrated that the environments of distance learning courses can be improved through the application of aesthetic principles. The selected criteria were useful to this Instructional Designer and could prove successful in improving the appearance of other online courses.

Little research has been conducted on aesthetics and online educational media. This project has simply developed one set of guidelines and explored their effects. The incorporation of aesthetics into the online learning environment needs dedicated research to clarify the need for aesthetic treatments and their effects on student satisfaction and motivation. In addition to a larger amount of studies, this area of research would benefit from a significantly broader course selection and a larger student population. Furthermore, this project has focused on the development and application of criteria for use by general faculty. Research into the effects of aesthetic elements applied by professional graphic artists would be useful in determining the importance of a quality visual online environment.

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