Section 2
Instructional Design
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Section 2 - Instructional Design

In this section we will attempt to briefly describe the instructional design process for traditional as well as Web-based instructional materials. We will begin by providing a synopsis on the current status of Web-based distance education in Higher Education institutions. Then, we will assess the current instructional design process used in GSLIS courses and propose an instructional design method and process for Web-based education.

2.0 Current status of Web-based distance education in higher education institutions

According to a February 1998 report by the National Center for Education Statistics (NCES), a majority of colleges and universities (58 percent) offered distance education courses or planned to do so by the end of 1998. Institutions can be categorized as: public 2-year, private 2-year, public 4-year, or private 4-year. A much greater percentage of public than of private institutions offered distance education courses: 58 percent of public 2-year and 62 percent of public 4-year institutions offered distance education courses, compared with 2 percent of private 2-year and 12 percent of private 4-year institutions. In academic year 1994-1995, an estimated 25,730 distance education courses with different catalog numbers were offered by higher education institutions. By fall 1995, an estimated 690 degrees and 170 certificates were offered (U.S. Department of Education).

The 1998 NCES report further states that an estimated 753,640 students were formally enrolled in distance education courses at these higher education institutions in academic year 1994-1995. Public 2-year institutions enrolled the most distance education students (414,160) and public 4-year institutions also enrolled many distance education students, 234,020. Distance education courses were delivered by two-way interactive video at 57 percent of the schools that offered these courses, while another 52 percent offered classes by one-way prerecorded video. This report also reveals that many institutions allow students to receive certificates and degrees by completing work exclusively through distance education courses (U.S. Department of Education).

The new trend is to offer distance education courses over the Internet. The reasons for using the Web are:

- to deliver course materials
- to use online resources
- to expand the classroom
- to support a variety of learning styles
- to provide a broad audience for student work
- to develop information age skills.

The dramatic emergence of the Internet and the World-Wide Web have suddenly created a way of transcending many of the problems associated with earlier forms of distance education. Web technologies are capable of delivering text, data, images, audio, and video in an integrated and coordinated manner. Moreover, “chat” rooms that allow nearly synchronous e-mail exchanges, electronic whiteboards that allow people to co-produce drawings at a distance, and fledgling imaging technologies that bring two-way, live video to a computer screen open the possibility of real-time exchanges, not only between students and teachers who are separated in space but among students who are themselves distributed.

2.0.1 Web-based distance education providers

The all-electronic institutions vary greatly in structure. Some are little more than Web sites that direct students to courses offered by traditional institutions. Others are institutions in their own right, with administrators, accreditation, and the ability to grant degrees.

According to *The Chronicle of Higher Education (1998),* several institutions have grouped together as regional and national consortia, by state, and by system.

- Regional and National Consortia:

The West: Western Governors University (Alaska, Arizona, Colorado, Guam, Hawaii, Idaho, Indiana, Montana, North Dakota, Nebraska, New Mexico, Nevada, Oklahoma, Oregon, Texas, Utah, Washing, and Wyoming)
The South: Southern Regional Electronic Campus (the Southern Regional Education Board, whose members are Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia)
The Midwest: Indiana, Michigan State, Northwestern, Pennsylvania State, Purdue, and Ohio State Universities, Universities of Illinois at Urbana-Champaign, Iowa, Michigan at Ann Arbor, Minnesota-Twin Cities, Wisconsin at Madison
Community Colleges: Cuyahoga Community College, Dallas Community Colleges, Foothill/De Anza Colleges, Kern Community College, Kirkwood Community, Miami-Dade Community, Rio Salado College, Sinclair Community College.

- Statewide: California Virtual University, Florida's Campus, Indiana College Network, University administrators in Iowa, Massachusetts (Distance Learning Honors Courses: public universities and colleges in Massachusetts), Pennsylvania Virtual University.

- Systemwide: Stanford University, Connecticut State University System, State University of New York, University of Texas System, Regents College.

In 1995, the governors of Colorado, Utah, and several other Western states established the Western Governors' University with the purpose of exploiting information technologies to deliver higher education to students distributed over time and space using delivery methods such as email, WWW, closed-circuit cable television, video and audiotapes, videoconferencing, satellite broadcasts, voice mail and others.

One example of an institution that has been successful with distance education is the University of Phoenix, which has become the second largest private university in the United States, enrolling more than 31,000 students. Another example of an institution utilizing distance education is Stanford University's Engineering School, where students can sign up for courses using the Web, and many classes at Stanford have Web pages that serve as a repository for class notes and assignments. Since 1969, the Stanford Center for Professional Development (SCPD) has offered more than 250 engineering courses annually, and has enrolled more than 5,000 students each year. Stanford University is the first to incorporate video with audio, text, and graphics. The classes are selected from the Stanford Instructional Television Network schedule. The Instructional Television Network offers full-length Stanford graduate courses in engineering and computer science for degree, non-degree, and audit programs. Courses are offered through several delivery systems and supported by SCPD broadcast operations such as microwave transmission (transmitted within a 35 mile radius of Stanford), Stanford Online (via WWW), tutored videotape instruction, and two-way compressed video (using videoconferencing technology). Oregon State has an object-oriented programming course in which there are no lectures; students submit email answers to study questions and take online exams.

Regents College was founded in 1971 by the New York State Board of Regents as the External Degree Program of the University of the State of New York. Regents College is a private, independently chartered institution based in Albany, New York. It is governed by a board of trustees composed of a national group of prominent leaders in education, business, and the professions. Regents College has over 17,000 enrolled students. Approximately 15 percent of these students come from New York State and 85 percent come from all other states and several foreign countries. The College has over 80,000 graduates.

2.0.2 Opportunities of Web-based distance education

Some opportunities of Web-based distance education are:

- Instructors can use information collections on the Web as supplemental readings or as the basis for assignments.
- Instructors and students have direct access to a variety of information systems through the WWW.

- The WWW can be used to distribute course materials. Online materials may provide students with greater access to the materials, both during and after the course.
- Students with little technical experience and no programming skills can quickly create prototype information systems.
- Instructors can use the WWW to create systems that support new, innovative classroom activities.
- The WWW makes it possible for instructors to observe the techniques and content that others are using.
- Online materials can be accessed by many individuals.
- The WWW server logs, which record each access to the online documents, can provide instructors with extensive information about the student's use of the course materials.

2.0.3 General issues of web-based distance education

- Credential Creation vs. Expertise Creation
  Traditional education systems have come to emphasize the importance of the credential that they provide. However, it is incorrect to assume that all students are interested in developing their official credentials. In many cases, professional and other non-traditional students are more concerned with expertise development than credentials. Educators need to determine whether individuals have learned from a particular educational program; learners want to be provided with a means to "prove" to others that they have learned. To what degree is it feasible to separate the credential aspects of education from the expertise development aspects? What are the implications of separating or combing credential creation and expertise creation for Web-based education design?

- Money Matters
  Many Web-based distance education programs can seem like cheap alternatives to traditional classroom education. In reality, the opposite is true. Web-based distance education can be expensive to develop and implement. It requires massive infrastructure, and while some universities and individuals can afford the costs, many cannot. The costs of implementing Web-based distance education systems and training people to use the technology have slowed their adoption. Web-based distance education is not profitable at this point. Thus, while the discussion of alternative models of Web-based distance education is useful, it will ultimately be unused unless it is possible to charge students additional fees to cover the increased costs. One alternative is for the university to waive fees that do not apply to distance education students. What assumptions do existing administrative and institutional structures make about students and how do those assumptions affect the design of Web-based distance education? What payment schemes are available that make it feasible to provide Web-based distance education?

- Structuring for Stability vs. Structuring for Change
  The traditional education schedule exists to create stability. Synchronizing students' schedules stabilizes the timing of educational activities providing instructors with a cycle of plan, execute, and evaluate that stretches over several months. However, students need to change these structures in the education system. Web-based education changes the demands placed on instructors and educational institutions. What impact does Web-based distance education have on the work and schedule of individual instructors? What impact does Web-based distance education have on educational institutions?

- Marketing issues
  Practical considerations for providers include the organization of the training programs and the marketing of distance training to the proper audience. To keep the students interested, educational providers must create a program that appeals to the proper audience.

- Social arena
  Web-based distance education is inadequate for certain types of skills such as soft interpersonal skills. The ability to learn to interact with other people including interpreting body language and voice tone will not be able to be duplicated with asynchronous communication.

- Cultural issues
  Teacher skepticism can affect the acceptance of distance education by students. Teachers must show the same level of enthusiasm as they would toward a traditional class. If the teacher does not believe that distance education will work, then his/her students will have a more difficult time succeeding.

- Technical constraints
  Students can be stratified by technological abilities and access levels. The differing entry-level technological skills of students can separate students into those who feel comfortable with technology and those who do not. Students who are uncomfortable with the technology may simply avoid using it. Other students may be interested in the technology, but not have access to the bandwidth necessary to receive training properly.

2.1 Instructional design background

What is instructional design? Instructional design (ISD) provides a systematic approach to analyzing, designing, developing and evaluating instruction. Instructional design takes the knowledge from various fields - behavioral science, systems theory, information processing theory, psychology, education, audiovisual field, and the military - and applies it to the instructional analysis, design, development and evaluation of instruction.

The use of the instructional design process provides many advantages to professionals designing traditional or technology-based instruction:

① Allows for the identification of the important roles of all components included in the instructional process.
② Focuses on the learner and what he/she will achieve at the end of instruction.
③ Promotes efficient and effective instruction.
④ Facilitates congruence between objectives, activities and assessment.
⑤ Facilitates the communication among designers, developers and deliverers.

The latter is particularly important in Web-based education, where multiple members of a team must work on an instructional product.

Many universities utilize the instructional design process and value its advantages in designing and developing WBDE. According to Truman-Davis and Hartman (1998), the University of Central Florida is one of those institutions as the following excerpt illustrates:

> After faculty successfully complete a six-week course to learn to teach on-line, high quality Web-based learning environments are created through a team that consists of subject matter experts (faculty), instructional and graphics designers, programmers, and cybrarians…. Course production is best done when the faculty have taken sufficient time to examine their pedagogical goals. Many schools do not require faculty to learn instructional design to make on-line environments, which may lead to unpredictable results and miss the opportunity to transform the curriculum. In addition to using the jigsaw method of distributed class work among the design students, formative evaluation was used as a key to integrating theory and practice.

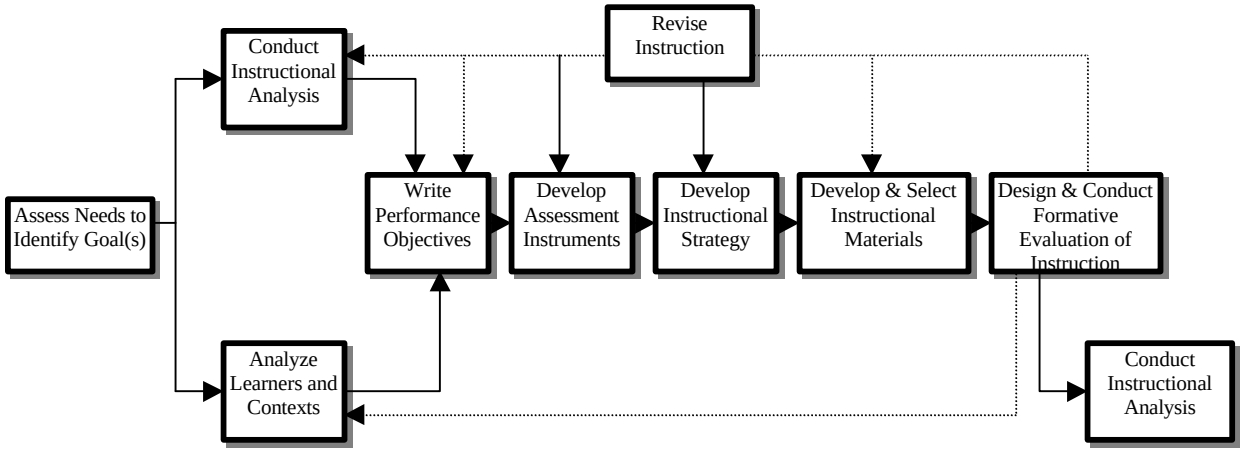
2.2 Instructional design models

2.2.1 Traditional models/Systems approach models

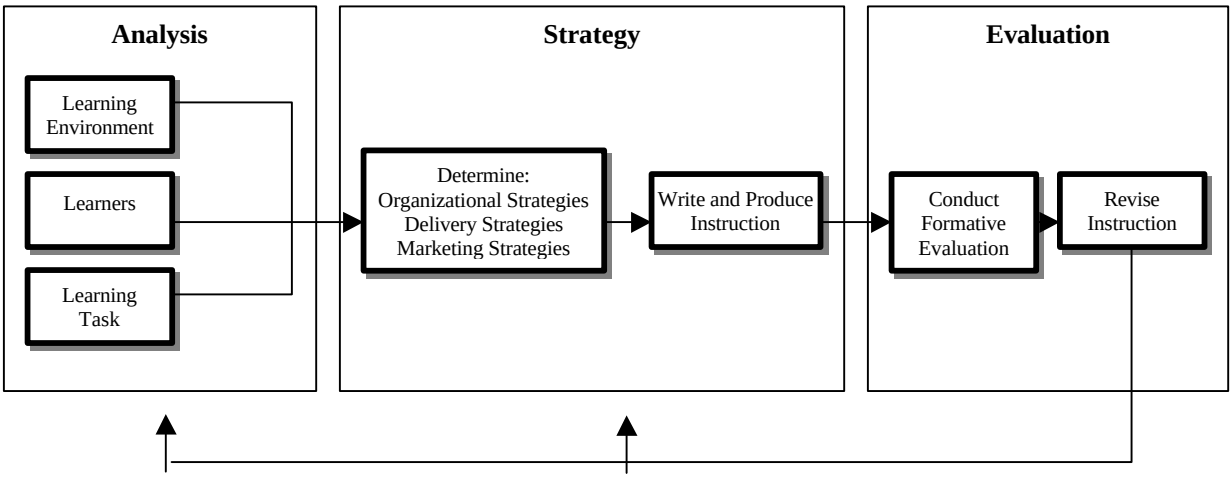
The traditional model of the instructional process was based on the notion that it was the instructor's responsibility to teach content to learners. Therefore, the way to improve learning was to improve the instructor by requiring additional training.

Dick and Carey (1996) perceive the instructional process from a systems approach in which every component is critical to successful learning. The systems point of view adheres to the belief that teachers, students, materials, and learning environments are interrelated parts which work together toward defined goals. Another important aspect to effective learning is assessment of the effectiveness of the system and effecting changes as needed. The flow chart below refers to procedures and techniques used in the instructional design process to design, produce, evaluate, and revise instruction.

Dick and Carey Systems Approach Model for Designing Instruction



2.2.2 Distance education/Web-based course model



Source: Smith and Ragan, Instructional Design, 1993.

Effective distance education depends on the developer's knowledge of instructional design and how to use instructional design concepts in developing distance education courses.

According to the document, A Survey of New Media Development and Delivery Software for Internet-Based Learning, an instructional design process for Internet-based learning consists of five phases: analysis, design, production and pilot testing, implementation, and evaluation.

Phase	Typical Activity	Product
Analysis	• Project plan • Needs assessment • Audience analysis • Content/task analysis • Technical analysis and authoring/media tools selection • Set learning goals and structure	• Analysis report
Design	• Learning objectives • Instructional strategies and lesson designs • Interaction design and media treatments • Evaluation design	• Design document with paper or electronic prototypes
Production and Pilot Testing	• Media production/sourcing • Programming/coding • Authoring and integration of media elements • Pilot testing (field trials) and revisions as needed	• Tested (instructionally and technically valid) courseware ready for implementation
Implementation	• Distribution of course • Reporting and tracking • Logistics and maintenance	• Implemented course • Student learning
Evaluation	• Learning and effectiveness evaluations	• Evaluation report and recommendations

2.3 A design model for GSLIS

Sections 2.1 and 2.2 listed the steps followed in the systems approach model as well as the steps for Web-based instructional design. These models share common and slightly different components and characteristics. For this reason, we have combined elements of these design models into one model that we believe can be implemented by the GSLIS department in the design of traditional or Web-based instruction.

Each step of the ISD model will be described and recommendations will be provided in the following sections.

2.3.1 Other issues involved in designing and developing Web-based courses

Some of the issues that must be considered when designing and developing WBDE are time, costs, team development, and student, faculty, and staff skills. All of these variables are interrelated and affect the design and production process.

2.3.1.1 Time factors

Time is one of the first factors that must be assessed before designing and producing Web-based courses. An estimation of design and development times has been provided by various universities. For example, a Web-based course design and production team from The University of Alberta, Canada calculated the time spent on developing and testing a Web-based course as follows.

Task	Hours
Development of course outline and identification of course resources	200
Original Web page design and major revision of course resources	400
Course revision during F2F delivery	60
Course revision prior to first asynchronous delivery	30
Course revision and delivery during first asynchronous delivery	750
Total	1440

Source: Costs of Developing and Delivering a Web-Based Instruction Course. (1998) Harapnuik, D, Montgomerie, C, Togerson, C.

Although we have provided estimated project design and development times, there are many variables that can affect these times. Davidson G., & Smith P. (1991) provide us with a list of variables that can affect computer-based instruction development times. These factors are easily applicable to the WBDE design and development process.

Factors Affecting Development Time	
Requirements for media integration	Experience of developers
Complexity of instructional objectives	Number and location of team members
Required level of interactivity	Project management skills
Degree of learner control desired	Role clarity
Complexity of instructional strategy	Client experience/commitment/time
Degree of branching	Team turnover
Nature, complexity, and volume of graphics, animation, and sound	Political factors
Clarity of design specifications	
Number and timing of changes requested by client	
Volatility of content	
Availability of authoring/productivity tools	
Hardware capabilities and limitations	

Source: CAI: Design & Languages Course Packet. Davidson G. & Smith P., 1991

2.3.1.2 Cost factors

Another important factor that must be considered is cost. Costs include technology, transmission, maintenance of equipment, network infrastructure, production costs to develop and adapt teaching materials, support expenses, and personnel to provide all of these functions (Willis, 1993).

2.3.1.3 Skills needed by students and faculty

The characteristics of effective distant students include students who are voluntarily seeking further education, have post-secondary education goals with expectations for higher grades, and are highly motivated and self-disciplined. Effective instruction requires extensive pre-planning, well-designed syllabus and presentation outlines, properly trained teachers in the use of the equipment and in those techniques proven effective in distance education environment (Willis, 1993).

2.3.1.4 Team development

According to Carlson, Downs, Repman, and Clark (1998), team development is a crucial part of course design.

> The initial phase of course design would include a team organized to conduct a needs analysis. Academic units need to determine if existing courses and course sequences are suited for online

offering, if existing programs could be modified, or whether new programs are more appropriate. Content experts, instructional designers, end-users or practitioners, graphic designers, Web page designers, program administrators, and university administrators all need to be included in various phases of the design process.

Here is an example from Chippewa Valley Technical College (CVTC). The Distance Education Team guides the CVTC Virtual Campus. The Distance Education Team reviews the practices, procedures, and scheduling for implementing their distance education effort. It is a cross-functional team with a diverse membership that represents the many activities needed to provide their distance education services and courses. The current membership includes: instructional design (team leader), curriculum, instructional delivery, counselor, distance education support, faculty, ITV facilitator, library technician, scheduling, and marketing.

2.4 Assessment of the use of instructional styles and instructional technology at GSLIS

The Instructional Design group provided the faculty at GSLIS with an Instructional Styles and Instructional Technology survey with the purpose of assessing the overall instructional design practices in GSLIS. The surveys were distributed to all members of the faculty but only a very small number responded to the survey. The extremely low number of responses to these surveys is an indicator of one or more of the following conditions: survey clarity, complexity of design, faculty's lack of time to complete the survey, faculty's lack of interest, and faculty's lack of knowledge of the department's instructional practice tendencies. All of the conditions, except the first, are out of the Instructional Design group's control. The last condition in particular might be a symptom of the department's lack of communication.

In fact, when asked why the faculty had failed to respond to the instructional design surveys, a faculty member responded that it was difficult to assess what the department was doing as a whole because faculty members were not aware of what others were doing. If this is the case, then the GSLIS department must reassess its communication practices. The success in the implementation of a new system depends first and foremost on communication. For a major change to take place, the organization must maintain open communication between all the members of the system. Additionally, all members must work towards a same goal.

2.4.1 Instructional styles survey results

The Instructional Styles Survey's purpose was to determine and compare the level of the current and desired instructional practices in GSLIS. Instructors were asked to rate various types of instructional activities in terms of their current use and future (five years) use within GSLIS. They were asked to determine if these activities were very strongly teacher-centered, in the middle of the continuum between teacher-centered and student-centered or very strongly student-centered. Instructors were also asked to rate these activities in terms of the instructional practices desired in the next five years.

The survey results are not scientific and present the views of a limited number of faculty members. However, the survey can give us an impression of the instructional practices used within the department. Of the six instructors who responded to the survey:

- Three instructors see the current instructional styles practices at GSLIS as balanced between the teacher-centered and student-centered. All three foresee the instructional styles in the future as continuing to be balanced between teacher-centered and student-centered with a strong emphasis toward student control.
- Two instructors see the current instructional practices at GSLIS as balanced between the teacher-centered and student-centered approaches. These same instructors in general see the future practices as being balanced between the teacher-centered and student-centered approaches.
- One instructor sees the current instructional practices at GSLIS generally as learner-centered and foresees them as being more learner-centered in the future.

2.4.2 Instructional technology survey results

The Instructional Technology Survey's purpose was to evaluate the level of instructional technology use in GSLIS. Instructors were asked to rate the extent to which GSLIS currently uses instructional technology in the classroom. They were asked to rate on a scale from zero to four, nine instructional technology use indicators in terms of their extent in current practice. The scale used was the following:

4=Exemplary Level Use	Maximum points for this level= 144
3= Fully Functioning and Operational Level	Maximum points for this level= 108
2= Evidence of Progress	Maximum points for this level= 72
1= Low Level of Implementation	Maximum points for this level= 36
0= Absence of Evidence	

As with the Instructional Styles Survey, the responses to this survey were very limited. In fact, only four instructors responded to it. However, the limited responses can provide us with some data regarding instructional technology use in the department. The results of the survey indicate that:

- Of a total of 144 possible points (indicating exemplary level of instructional technology use), the result of the rating points assigned by the four instructors is 79. These results indicate that these instructors have seen evidence of progress and a minimum operational use of instructional technology in the department.

The instructional design surveys provided to the GSLIS faculty provides us with little data to get an accurate picture of the state of instructional practices. Without an accurate or close to accurate picture, it is difficult to provide generalized recommendations. However, the limited data uncovered by the surveys allows us to provide these few recommendations:

- To be able to embrace the WBDE initiative, the GSLIS department must work to keep open communication among all members of the department.
- Because WBDE assumes a more learner-centered approach in the classroom, it is very important that instructors use or be willing to use this strategy. The limited data provided by our survey indicate that the majority of the instructors that responded tend to favor this type of approach.
- WBDE requires the extensive use of technology in the classroom. Our limited survey results indicate that there is some evidence of use of technology in GSLIS. However, this evidence might not be enough to migrate to fully technology-based learning solutions. For GSLIS to successfully implement WBDE, it must increase each instructor's technology use in the classroom. If instructors are comfortable with technology, they will be comfortable with the technological aspects of WBDE.

2.5 Description of GSLIS instructional design model components

2.5.1 Analysis

The ISD process begins with the analysis component. At the analysis stage, the team conducts a needs assessment, audience, instructional, and technical analyses, and develops a project plan.

2.5.1.1 Needs assessment

The needs assessment process helps us determine the future goal of the organization or plan, identify the current organizational situation, and identify the objectives that need to be reached in order to attain the future goals. An initial needs assessment has been initiated and conducted by our group.

2.5.1.2 Audience analysis

At this stage, we identify the learner characteristics that affect and influence instruction. Data are gathered about students' general characteristics, cognitive levels, affective and social behaviors, and general knowledge. In the case of WBDE, entry-level knowledge related to students' technological capabilities is important since it determines students' computer expertise. An initial audience analysis is provided in the student section of this paper.

2.5.1.3 Learner characteristics

Ehrlich and Kommel (1998) have defined learner characteristics as:

> Learner characteristics reflect the demographics, learning styles, readiness, and motivation to learn of the target audience. Variables such as learner expectation affect the amount of time, the level of instruction, and the varied approaches that are required. Web-based instruction enables the instructor to individualize learning to accommodate many of the factors… A comfort level and easy access to computers is essential if the course is to be Web-based.

Below are some questions Ehrlich and Kommel (1998) suggest need to be asked in order to determine learner characteristics:

- What demographics are important when designing instruction (gender, ethnicity, age, etc)?
- What is the size of the learner group?
- Where are the learners located geographically? Is access a consideration?
- What are the attributes of the learners? Are these particular strengths or limitations that would have an impact on instruction?
- What are the learning style preferences of the group? Does this have an impact on the instructional design?
- What prerequisite skills do the learners have/need? How will you address these differences?
- Are the learners there by choice or are they required to attend?
- What expectations do learners bring?

2.5.1.4 Technical analysis

This stage identifies the organization's technical and student capabilities. It also involves an educated selection of the right tools to design and deliver WBDE. An initial technical analysis is provided in the technical analysis section of this paper. A short discussion on the selection of the appropriate WBDE delivery options according to desired level of interaction is provided later in this document.

2.5.1.5 Instructional analysis

The purpose of this component is to determine what content should be included in the lesson. There are many methods to conduct an instructional analysis. Dick and Carey (1986) and Gagne, Briggs and Wager (1988) are two of the many sources that discuss ways to conduct instructional analyses. One of the main activities that must be performed during an instructional analysis is the identification of the learning domain or outcome to which the content in a lesson belongs. Identification of the learning domain is a necessary step to guarantee that the lesson content will be covered appropriately. According to Gagne, Briggs and Wager (1988) the knowledge can be classified into these five learning domains:

1. Intellectual Skills: "Learning how to do something of an intellectual sort."
2. Verbal Information: "Learning that something exists or has certain properties."
3. Cognitive Strategies: "Capabilities that govern the individual's own learning, remembering, and thinking behavior."
4. Motor Skills: "Learning to physically perform a task."
5. Attitudes: "Choice of a course of personal action."

2.6 Analysis of GSLIS Courses suitability for WBDE

This section provides a brief analysis of some GSLIS courses as well as a guideline for the analysis of future GSLIS courses. The courses we analyzed for this section were the MLIS core, kernel courses for the Information Science Track, and the LIS 382L, LIS 385T, and LIS 384K group of courses offered for the Information Science Track. We narrowed down the number of courses to this sample because of the complexity of the course analysis task, the large number of courses, and because of the changes that will be implemented in the GSLIS course offerings.

The overall factor identified through research and analysis of courses is that provided they are well designed, all courses can be offered on the Web. The differences among courses lie in that some courses will require more modifications than others.

The factors we used to determine which courses are the most appropriate for WBDE are the following:
1. Level of social interaction – teacher/student and student/student
2. Teacher willingness
3. Resources – difficulty to obtain course resources
4. In-person requirements - field trips/guest lectures or student presentations
5. Content stability

We then evaluated these factors for each group of courses using the following scale:
Evaluation scale
**** Perfect for the Web, no major modifications necessary
*** Suitable for the Web, but some modifications required
** Possibly suitable for the Web, but substantial modifications needed
* Not suitable in current format

The maximum evaluation points a group of courses can get are 20 points (5 factors at 4 stars/points each).

2.6.1 Analysis of courses

2.6.1.1 Core courses of MLIS

LIS 386.1 – *Introduction to Library and Information Studies*
LIS 387.1 – *Administration of Libraries and Other Information Agencies*
LIS 397.1 – *Introduction to Research in Library and Information Science*

1. Middle level of interaction required - ***
2. Teachers generally willing to teach these courses - ***
3. Course packets - ***
4. Courses with field trip component can require students to go to a comparable site or come to Austin for specific time for field trip. Students can also meet in class for presentations or presentations can be substituted by projects or papers. Presentations can be made by video tape or video conference - ***
5. Very stable content for all courses - ****
   OVERALL ANALYSIS: 16 – low level of modification to current course format overall

2.6.1.2 Kernel courses for the Information Science track

LIS 384K.10 – *Information Networks*
LIS 387.5 – *Systems Analysis and Evaluation*

1. High level of student-student interaction - difficult to manage electronic communications - **
2. Teacher willingness high with Fall 1999 professors - ****
3. Textbooks, Web-based, course packets - **
4. No field trips - ****
5. Somewhat stable content - **
   OVERALL ANALYSIS: 14 – some modification or ongoing course updates required, student-student interaction needs more professor input

2.6.1.3 Information Science track

LIS 382L – Information Resources and Services
1. Mid-level of student-student interaction - ***

2. Many different teachers can affect teacher willingness - **
3. Textbooks, course packet, reserve materials, online resources – more difficult to obtain needed information – number of resources required can be very high - *
4. Many field trips – time in libraries – many different libraries - *
5. Content stable - ****
   OVERALL ANALYSIS: 11 – modification of field trips, reserve materials

LIS 385T – Information Science and Knowledge Systems
1. Individual projects primarily, limited group projects - can require teacher student interaction - ***
2. High teacher willingness based on Fall 1999 professors - ****
3. Textbooks, reading packets, Web-based materials - ****
4. Low field trips/guest lectures - ****
5. Content changes for many of these courses - ***
   OVERALL ANALYSIS: 18 – easily transferred to Web, high teacher willingness to embrace technology

LIS 384K – Access to Information and Materials
1. Individual projects primarily, some entire class projects - ***
2. Strong willingness based on Fall 1999 professors - ****
3. Textbooks, course packets, online resources - ****
4. No field trips, specific software (CD possibly) - ****
5. Fairly stable - ***
   OVERALL ANALYSIS: 18 - easily transferred to Web, high teacher willingness to embrace technology

2.6.2 Design

The second step in the ISD process is the design phase. At this stage the team develops learning objectives, tests, and instructional strategies, selects media, and determines how the information will be covered on screen.

2.6.2.1 Design guidelines

Delivering professional development courses asynchronously over the WWW involves many instructional design issues. Following are six guidelines for the design of WBE courses. According to Winfield, Mealy, and Scheibel (1998), these guidelines are used for structuring learning activities to enhance student motivation and participation:

- Build up user confidence with technology.
- Build in the instructor's presence and personality.
- Provide a clear set of learning activities.
- Build on personal and professional experience of participants.
- Relate content to real situation using case studies and simulation.
- Build in collaboration and facilitated team projects.

2.6.2.2 Learning objectives

Ehrlich and Kommel (1998) state, "objectives are related directly to the goals and focus on desired learning outcomes. They need to be written in measurable terms, so that the success of instruction can be measured. Learner objectives are similar whether they are in distance learning or on-site instruction…Adult learners tend to use objectives to measure their own accomplishments, so it's important to make them known at the beginning of the instruction."

To be effective, learning objectives need to clearly specify and communicate the desired learning outcome. Therefore, you must use verbs that reflect the learning outcome desired (Department of the Air Force, 1993). The table below is an example of learning capabilities and the verbs that can be used to convey each capability.

Capability	Capability Verb
Intellectual Skill • Discrimination • Concrete Concept • Defined Concept • Rule • Higher-Order Rule (problem solving)	 • Discriminates • Identifies • Classifies • Demonstrates • Generates
Cognitive Strategy	Adopts
Verbal Information	States
Motor Skill	Executes
Attitude	Chooses

Source: Instructional System Development. Department of the Air Force. AF Manual 36-2234. 1993

A few simple questions to determine if objectives are appropriately written as stated by Ehrlich and Kommel (1998):

- Are the objectives derived from the goals?
- Are the objectives stated in measurable terms so that the learner understands what he/she is responsible for?
- Do the objectives contain actions, conditions, and criteria for performance?
- Are the objectives sequenced appropriately for the tasks/content?
- Do the objectives reflect the desired domains?

2.6.2.3 Test development

Test development is a very important factor in the design of instructional lessons. There are various types of testing that can occur during an instructional process. Dick and Carey (1988) identify the four types of tests as:

- Entry behavior test: Assesses and identifies the skills that students must have prior to beginning instruction. In WBDE, an entry behavior test can be provided to students in order to determine their technological skills.
- Pretest: Assesses the skills that will be taught in instruction. Its purpose is to determine how much prior knowledge the student has about the instructional content.
- Embedded test: Provides practice items to the students.
- Posttest: Assesses all of the objectives presented in instruction with a final test.

Tests must match the objectives and the learning outcomes they support. The Instructional System Development Department of the Air Force (1993) provides us with examples of the method of testing most appropriate for certain learning outcomes. The procedures are listed in the table below.

Type of Learning Outcome	Best Method of Testing	Activities that indicate achievement of objectives
Intellectual Skills: • Discriminations	• Multiple choice and true/false	• Detect similarities or differences
• Concepts	• Constructed response (labeling, sorting, matching)	• Recognize examples or non-examples
• Rules	• Performance of integrated tasks or constructed response (short answer)	• Apply rule, principle or procedure
Verbal Information	Constructed response (fill in the blank, essay questions)	Recall information

Cognitive Strategies	Students explains process to examiner	Self-report or audit trail of work done
Motor Skills	Performance test	Perform smooth, coordinated action
Attitudes	Observe student in different situations	Observe actual situated behavior

Source: Instructional System Development. Department of the Air Force. AF Manual 36-2234. 1993

The table above provides us with examples of testing methods traditionally used in instruction. In WBDE, however, alternative ways of testing students on the Web can and must be developed. Oliver (1996) states, "the enhanced interactive capabilities of the Web provides the means for assessment of student learning to extend beyond conventional essays and examination". McLellan (1993) points out that "more reliable assessments can take the form of evaluation measures such as portfolios, summary of statistics of learner's paths through instructional materials, diagnosis, and reflection and self-assessment. Much of this can be achieved and supported through appropriate design of WWW documents and learning materials."

2.6.2.4 Development of instructional plan

2.6.2.4.1 Determine instructional strategies and learning design

The design of WBDE includes instructional strategies and learning design. Gagne et al. (1988) define instructional strategy as "a plan for assisting the learners with their study efforts for each performance objective. Traditionally, instructional designers have looked to specific strategies based on learning outcomes to guide how to teach/assist learners in learning content and processes. When teacher-led, group-paced instruction is planned, teachers use the instructional design process to produce a guide to help implement the intent of the lesson plan without necessarily conveying its exact content to the learners. The teacher gives directions, refers learners to appropriate materials, leads or directs class activities, and supplements existing materials with direct instruction. On the other hand, when a learner-centered, learner-paced lesson is planned, a module is typically presented to the learner. It usually presents a learning objective, an activity guide, the material to be viewed or read, practice exercises, and a self-check test for the learner. In this case, the instructions or activity guide in the module is written for the student rather than for the teacher. Designers can use the process for both teacher-led and modular materials."

2.6.2.4.2 Include opportunities for interaction

The design of Web-based instruction must include opportunity for student's collaboration and articulation. Instructional activities must encourage higher-order thinking and critical reflection and also must provide students with an opportunity to work in groups, discuss issues, and debate, articulate, and defend their knowledge (Oliver, 1996). The Web provides opportunities for these activities to be implemented.

A very important factor to consider when determining the instructional strategies and designing instruction is interactivity. There are many interpretations and definitions of the term interactivity. Based on some definitions of interactivity, Gilbert (1998) was able to identify two main types of interactivity that are crucial to learning design--particularly Web courses. According to Gilbert, these two common types of interaction present in the classroom must be replicated in Web courses. These two main types are social interactivity and instructional interactivity.

Social interactivity refers to the social exchanges between students and teachers and between students and students. Zhang and Fulford (1994) indicate that the way in which students perceive the social interaction of a course can have significant effects on learning. Additionally, Gilbert (1998) states that although social interactivity can have little to do with or directly not support instructional learning, it can help create a positive or negative learning environment and provide students with feedback about their instructional progress. Some social interactions (e.g., group discussions) can directly support instructional interactivity (Gilbert, 1998). Instructional interactivity, on the other hand, refers to student interaction with the learning content.

Below is a table listing the activities common to each type of interactivity, the characteristics of each type of interactivity and examples of technology that support each type of interactivity.

Social Interactivity

Types of Interactivity	Body language Greetings Socializing Exchanging personal information Scheduling Logistics (e.g. handouts) Class Management
Characteristics	Usually real time (synchronous) Immediacy of interaction Interruptible Usually bi-directional Alternation of turns Mutuality Learner control usually present Can be teacher to student, student to teacher, student to student, group or whole-class
Examples of Technologies	Face-to face contact via audio and/or video Email Online chat Electronic bulletin boards Moderated discussion Calendaring programs Message replication Work flow control Real-time electronic discussion Shared whiteboard

Instructional Interactivity

Types of Interactivity	Communication of content Setting objectives Questioning Answering Exchanging Information Pacing Sequencing Branching Adapting Evaluating Individualizing Handling Responses Confirmation of learning Controlling navigation Elaboration
Characteristics	Goal/criterion-directed Variable teacher directivity Variable learner control Control of sequence

	Control of pace Availability of inquiry options Evaluation of responses Synchronous or asynchronous Immediacy vs. delay Variable bi-directionality Variable individualization Man or machine provided
Examples of Technologies	Shared whiteboard Computer application Sharing Lecture Information query Responding to query File distribution Replication and revision Database storage and access Database search Monitoring responses Proctoring correct answers Testing to criterion

Source: Building Interactivity into Web Courses: Tools for Social and Instructional Interaction. Gilbert 1998.

Web-based courses should be designed to support social and instructional interactions. There are many Web tools that can help build such interaction into Web-based courses. Gilbert (1998) classifies these Web tools into four groups and evaluates them in terms of their effectiveness in supporting social and instructional interactions.

① Native Web capabilities available through Web browsers. Encourages and facilitates transfer of information but browsers support few interactive components listed in the table above. (Gilbert, 1998)

② Commercial groupware products (e.g. Lotus Notes or Microsoft Exchange). Applies to limited types of interactions, mainly social interactions.

③ Programming tools with preprogrammed templates (e.g. Authorware, Toolbook). Can provide advanced instructional interactivity but often must be combined with advanced programming tools such as C++ and CGI scripting.

④ Hybrid Course Design Programs (e.g. Lotus Learning Space and WebCT). Include preprogrammed templates and programming that allow designers to incorporate instructional interaction. However, they include limitations such as: the preprogramming of instructional interactivity is limited to simple techniques; most of the features simply duplicate the social interaction; and class management features of commercial groupware and the programs are quite complex.

Based on the previous analysis, Gilbert (1998) suggests the following to select the most appropriate tools to build interaction.

- Web browsers or commercial groupware can support simple one-way information that requires almost no social interaction. Simple Web format also works well in simpler types of interaction where there is a high level of teacher control.
- For high levels of group interaction and collaboration where there is a lower level of teacher control, commercial groupware products can be used.
- Hybrid course design programs are suitable for one-way information common in lecture format as well as high levels of group interaction and collaboration. Also, the preprogrammed features allow for control of less complex types of interaction and collaboration where there is a high level of teacher control.
- Although programming tools can be used for highly instructor-led courses to highly collaborative courses, programming tools are more suitable and appropriate for high levels of learner control of interactivity since they allow the creation of feedback, loops, pacing, sequencing, and navigation.

Research findings on the need for interaction have produced some important guidelines for instructors organizing courses for distant students. These guidelines are:

- Learners value timely feedback regarding course assignments, exams, and projects (Egan, et al., 1991).
- Learners benefit significantly from their involvement in small learning groups. These groups provide support and encouragement along with extra feedback on course assignments. Most importantly, the groups foster the feeling that if help is needed it is readily available from other group members.
- Learners are more motivated if they are in frequent contact with the instructor. More structured contact might be utilized as a motivational tool (Coldeway, et al., 1980).
- Utilization of on-site facilitators who develop a personal rapport with students and who are familiar with equipment and other course materials increases student satisfaction with courses (Burge & Howard, 1990).
- The use of technologies such as fax machines, computers, and telephones can also provide learner support and interaction opportunities.

Willis (1993) states, "using effective interaction and feedback strategies will enable the instructor to identify and meet individual student needs while providing a forum for suggesting course improvements." To improve interaction and feedback, he suggests the following steps be considered:

- "Use pre-class study questions and advance organizers to encourage critical thinking and informed participation on the part of all learners. Realize that it will take time to improve poor communication patterns.
- Early in the course, require students to contact you and interact among themselves via electronic mail, so they become comfortable with the process. Maintaining and sharing electronic journal entries can be very effective toward this end.
- Arrange telephone office hours using a toll-free number. Set evening office hours if most of your students work during the day.
- Integrate a variety of delivery systems for interaction and feedback, including one-on-one and conference calls, fax, E-mail, video, and computer conferencing. When feasible, consider personal visits as well.
- Contact each site (or student) every week if possible, especially early in the course. Take note of students who don't participate during the first session, and contact them individually after class.
- Use pre-stamped and addressed postcards, out-of-class phone conferences, and e-mail for feedback regarding course content, relevancy, pace, delivery problems, and instructional concerns.
- Have students keep a journal of their thoughts and ideas regarding the course content, as well as their individual progress and other concerns. Have students submit journal entries frequently.
- Use an on-site facilitator to stimulate interaction when distant students are hesitant to ask questions or participate. In addition, the facilitator can act as your on-site "eyes and ears".
- Call on individual students to ensure that all participants have ample opportunity to interact. At the same time, politely but firmly discourage individual students or sites from monopolizing class time.
- Make detailed comments on written assignments, referring to additional sources for supplementary information. Return assignments without delay, using fax or electronic mail, if practical."

2.6.2.4.3 Instructional design and learning styles

The use of multimedia instructional tools required for the implementation of Web-based courses will afford instructors with the ability to address differences in learning styles of students beyond what is possible with more traditional teaching approaches. The following section will briefly describe individual differences in learning styles and possible means of contending with them. The summary is based on Howard Gardener's theory of Multiple Intelligences.

Three of Gardner's seven 'intelligences' seem pertinent in this context: Linguistic Intelligence, Spatial Intelligence, and Logical-Mathematical Intelligence. Each describes a cognitive process by which information can be processed and stored as a mental model. Some individuals may tend to favor one or more of these processes as a means of understanding and retaining information. If a student lacks proficiency in a particular cognitive process and instructional material is presented solely by this particular modality, this student will certainly have more difficulty understanding this material. If designed with these considerations in mind, Web-based instructional

tools could allow instructors an opportunity to present course materials so that a range of learning styles could be addressed.

Linguistic Intelligence involves the mental processing of information being carried out predominately by the interpretation of words and sentences. More traditional instruction (such as lecture) accommodates this intelligence. Providing students with either electronic transcripts of lecture material or access to video archives would facilitate this learning style.

Spatial Intelligence centers on visualization as a means of processing information. Web-based tools will allow instructors to present information through dynamic visual models that would help students master materials that would otherwise be difficult for them to envisage. With the use of electronic whiteboards, online discussions could occur by directly manipulating charts and graphs that are part of the course materials.

Students gifted in the domain of Logical-Mathematical Intelligence are able to cope with many different variables at once. In contrast, students lacking in this ability are required to learn difficult material in smaller steps. Asynchronous presentation of course materials would facilitate such a learning requirement. In addition, students with attention deficit problems could have the luxury of acquiring information in chunks that are more suitable for them.

It is clear that individuals respond more efficiently and effectively to various means of instructional presentation. In traditional classroom settings, the choice of presentation can mean the difference between a successful and unsuccessful educational experience for some students. Web-based instruction eliminates the need to choose between various styles of presentation by allowing the presentation of course materials in multiple formats, creating a richer educational experience for all students.

2.6.2.4.4 Selection of instructional/delivery system

This section deals with the selection of the most appropriate media for use in the Web-based education environment. Reiser and Gagne (1983) identify the factors that must be considered in media selection. These factors are:

- Physical factors: "The physical characteristics of the communications they are able to display."
- Learning Task: The learning outcome that must be achieved must be considered. "When intellectual skills are being learned, precise feedback to the learner about correctness and incorrectness of performance is a matter of great significance... When concrete concepts or rules involving spatial arrangements are being learned, the presentation of pictures is essential. When verbal information is to be learned the medium to be chosen must have the capability of presenting verbal material, either in print or via audio channel as speech. Attitudes are best presented by media that make possible the display of a human model and the model's message about personal choices" (Reiser & Gagne, 1983).
- Learner Variables: Learner characteristics must be considered when selecting media.
- Learning Environment: Budget, size of class, teacher capabilities and capabilities of staff, attitudes of teachers toward innovation are some of the variables that must be considered.
- Economy and culture: The attitudes toward media and the resources of the users must be considered.
- Practical factors: Some factors are cost compared to instructional effectiveness. Will teachers need additional training?

Selections of instructional delivery systems require more analysis than just to decide to use the technology without exploring how to take best advantage of its capabilities. Following are some questions to ask when choosing instructional/delivery systems. [1]

- "Has an in-depth analysis been done to explore the options available to support instruction and make the most informed choices?

[1] Instructional media can include text, graphics, animations, music, sound clips, or video. Here is a list of links and articles to help choose the right one. http://cuda.teleeducation.nb.ca/distanceed/resources.cfm?ID=71

- What are the advantages and disadvantages of each type of delivery system (print, hands-on, slides, field trips, computer-based training, interactive, etc.)?
- What are the most ideal systems for presenting the instructional material?
- How do learner characteristics impact the delivery of instruction?
- What constraints or limitations are there due to the current investment in particular instructional systems?" (Ehrlich, et. al., 1998)

2.6.2.4.5 Design of instructional activities

Ehrlich and Kommel (1998) state, "Instructional activities are the learning experiences developed to present instruction and allow learners to demonstrate their ability to meet the desired performance level. The number of activities and information to support each learning objective must be carefully considered because time is an important element to adult learners." Here are some questions to consider when designing or developing learning strategies.

- "What are the most effective ways of presenting this material to the learner?
- Is there a need for pre- or post-instructional activities to support the learning?
- How much learner control of the learning process is desired (self-paced, mastery, etc)?
- Do the strategies match the learner characteristics? Is there sufficient variety? Are the learners actively involved in the learning process?
- Has sufficient time and activities been designed to ensure mastery and transfer of learning?
- Are the instructional strategies compatible with the resources available?
- Do the activities match the task, topic, and domain requirements specified by the objectives? Have the learning activities been designed based on logistical concerns (comfort, space, convenience,[2] etc.)? Has there been sufficient time allocated for breaks and refreshments (if applicable)?
- Has the instruction been designed in such a way that the learner can bookmark his/her place and then return to the instruction?" (Ehrlich, et. al., 1998)

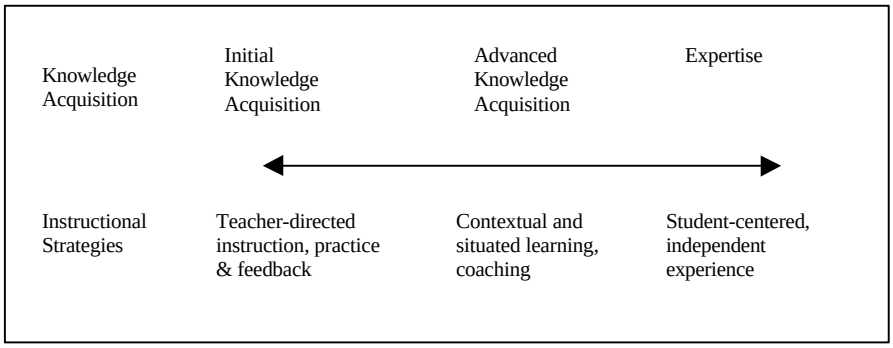
2.6.2.5 Content design and preparation

At this stage of the design process, group members concentrate on the way in which the instructional content will be organized and presented on screen. Some critical issues to consider when working on designing and presenting lessons for Web-based learning are organization, orientation, navigation, and presentation (Oliver, 1996).

2.6.2.5.1 Organization

Information on the World-Wide Web can be presented according to varying levels of linearity. Information presented through a minimum number of links that act to connect nodes in a sequence is known as linear (Oliver, 1996). In this type of linearity, students are compelled to follow a structure provided by the instructor (Oliver, 1996). Along the linearity continuum, the links tend to form a more hierarchical structure. This hierarchical structure gives learners more freedom in the choice of paths through the materials. As we follow the linearity continuum, the number of links increases and the linearity structure becomes more complex. This level provides a totally unstructured learning environment with multiple links between associated nodes. In this environment, learners are free to move between nodes and very little structure is imposed. (Oliver, 1996)

When choosing the correct type of hypermedia to use, instructional designers must look at the learning outcomes (Oliver, 1996). Mayes and McAleese (1993) provide a useful guide for selecting the correct form of hypermedia. (See figure)



Source: Oliver, 1996.

2.6.2.5.2 Orientation

Oliver (1996) defines orientation as "the means by which users are able to identify their current position in the system, how they achieved that position in the system and how to return to a previous position." Many research studies on hypermedia have identified disorientation as one of the problems most frequently experienced by students and a problem which limits instructional outcomes (Oliver, 1996). A hypertext study showed that 56% of users said they were unsure about where they were and 44% doubted they could find a topic they visited earlier (Nielsen, 1990). Horton (1994) identifies some of the forms of disorientation or the "lost in hyperspace" problem as follows:

Where am I? How did I get here? How do I get back to the starting point?
Where do I want to go?
How much have I seen?
How do I get out?

The design of hypermedia systems such as Web-based instruction should provide students with ways to orient themselves through the materials. Several strategies are available to facilitate student orientation through Web materials. Some examples are***:***

Use of placement cues. Placement cues allow users to view their distance and placement in the instructional sequence. Using bars and graphs in linear sequences provide visual cues to aid information (Oliver, 1996). Another useful strategy is to display the topic name and the path to it (Horton, 1994). Many Web pages use this approach to display the current topic and the path the user took to it. For example:

Home Page--Course Materials--Handouts--Designing Web Instruction

A third strategy to show user's placement in the instruction is to "give each screen or topic a short identification code" (Horton, 1994). Also, tell the user where they are in the sequence (Horton, 1994). For example:
Topic 1
Page 1 of 5

Use of hierarchies, indices, cognitive/mental maps. Provide the learner with an overall structure of instruction as well as access to information nodes. The overall structure of the instruction is reinforced as learners select and view the content (Oliver, 1996). The use of table of contents and index of topics supports this structure and facilitate students' learning by providing them with an advance organizer. Another alternative to support the use of hierarchies is the use of frames and targetable windows (Oliver, 1996). A third strategy includes the use of a "You are here" icon to show the user's location in the document (Horton, 1994) and the overall structure of the lesson. Maps or diagrams are also an alternative to show the system's organization (Horton, 1994).

2.6.2.5.3 Navigation

Oliver (1996) provides us with very helpful guidelines regarding navigation: Employ standard and intuitive modes to navigate through materials and mitigate the problems created by poor interface design. "When learners are compelled to think and consider how an interface operates when undertaking a learning task, their attention is split and the mental effort required to attend to information from multiple sources lessens that which can be applied to the actual learning task" (Chandler & Sweller, 1991). At the same time, if learners are not comfortable with the system, its instructional advantages can be lost (Gray & Sasha, 1989). Navigation should be designed to avoid the problems quoted above (Oliver, 1996).

2.6.2.5.4 Presentation

Presentation deals with all aspects related to displaying information on the screen. Such aspects include text structure, writing, chunking information, and presenting graphics, audio, video, and animations. Presenting information on paper is not the same as presenting information on screen. For this reason, all design of Web-based instruction must be preceded by an exploration of the presentation guidelines that apply to the computer screen.

2.6.2.6 Development of templates and standards

This is a very crucial step that should be implemented preferably prior to the design and development of all WBE courses. The development of templates and standards has multiple benefits.

- Helps have a system in place. This facilitates the training of people, and standardizes content.
- Guarantees that all navigation, buttons and other elements are consistently placed in same location. This helps reduce student cognitive overload by allowing students to concentrate on the instructional content rather than on the navigation.
- Encourages overall standard "look and feel".
- All employees work for the same goal and in the same direction.
- Facilitates communications among all parties.

The final product should be a document that outlines the standards. From these standards, templates can then be designed and implemented in the storyboard stage. The East-West project of the New Brunswick TeleCampus in Canada (http://teleeducation.nb.ca/eastwest/template/) has an online document that describes the standards and templates for their WBE courses. This online document provides a standardization process example that GSLIS can follow during its WBDE efforts. The document outlines:

- Policies and ethical use
- Role definition
- Organization of content
- Structure template
- Course and module organization
- Design and technical specification for developers (file sizes, formats, text and graphics specifications)
- Documentation
- File structure and naming conventions
- Page and graphic specifications
- Evaluation standards.

2.6.2.7 Storyboarding and flowcharting

After an appropriate instructional plan and interaction design and treatment, the next recommended step is the development of storyboards. A storyboard is an illustration that depicts how each computer screen will look and act. Its purpose is to clearly communicate to the client and production experts how each screen should look and how it should progress. Storyboarding has been used for years by video and movie producers to plan every detail of their movies. For example, Alfred Hitchcock and Steven Spielberg are among the many directors who rely and have relied on storyboards (Horton, 1994).

Storyboarding is a tool that aids in the planning of screens and sequencing of them. The appropriate use of storyboarding can improve the communication process between all members of the team, save money, and avoid many hours of frustration. A storyboard typically includes a screen number, the learning objectives the screen supports, a drawing of the screen with all graphic and text elements on it, interactions, graphic, audio, text, and animation descriptions, and programming and production notes.

Flowcharting on the other hand, provides the members of the team with an idea of how the lesson flows on screen from node to node and screen to screen. The navigation is clearly explained visually through the use of flowcharting techniques. Horton (1994) provides alternatives to show information flows within the lesson.

2.6.2.8 Evaluation of design

Evaluation is the process used to provide feedback to designers, enabling continual improvement of WBE. It should be a continuous process. Starting during the analysis phase of WBE design, evaluation underlies all other phases and processes associated with the creating of WBE. Perhaps what is more essential is that all members in WBE engage in the evaluation and take part in it in a variety of ways. The designers engage in evaluation as a self-check to ensure that they have considered all aspects in the creating of WBE, and to measure effectiveness of instruction as well as the learning environment itself. The learners engage in self-evaluation and re-assessment throughout their involvement in WBE. By cutting across the design process, the evaluation phase can bring together a variety of audiences and perspectives, strengthening the future enhancement of WBE (Hill & Land, 1998).

2.6.3 Production of courses

After the design of the course has been evaluated and improved, the descriptions of the content, storyboards and flowcharts are provided to the team of experts. They will give life to the lessons by taking the ideas from paper and translating them to images, text, audio and interactions on the screen. There are four stages in the production phase: media production, programming, authoring, and testing.

2.6.3.1 Media Production

When developing instructional media, make sure it supports the objectives, is student-centered, builds learning on learning and meets the design that was specified in the design phase. Additionally, use techniques that are consistent with the principles of effective learning, are appealing to the students, are interesting and meaningful to maintain student attention, and require student participation.

Some of the instructional media that can be used to deliver instruction are print-based material, slides, audio/video, interactive courseware, animations, interactive video, and mission scenarios. Development of instructional media products may be affected by several factors. These factors are: development personnel required, development time required, and development cost required. Developing instructional media products normally requires teamwork and various skills. Instructional developers are responsible for planning, scheduling, and ensuring that the instructional media get produced. Some development activities are draft/write scripts, edit, shoot and edit slide or video, narrate audio, develop audio, and develop graphics (Dept. of the Air Force, 1993).

An example of an institution offering Web-based distance education using technology other than text and graphics is Stanford University through Stanford Online. They use streaming software from NetShow/Vxtreme to integrate video and audio in a framework which features a table of contents and augmenting graphics. Steaming video technology allows compressed video to play back without interruption by buffering segments of the file separately. Stanford Online uses NetShow/Vxtreme and its Web Theater product family to encode and produce the content for Stanford Online. The technology enables 10 frames per second (fps) streaming video, and provides a full table of contents, allowing students the ability to access the material they need without wasting time guessing where the pertinent material resides on the course video.

2.6.3.2 Programming and Authoring

Programming is the stage of the process where experts create the code to produce the educational materials. In the case of WBDE, it is the stage in which the HTML, or more complex programming code is created. Authoring on the other hand, refers to programming by non-programmers. Authoring languages are any software used to create software, presentations, CD-ROM titles, and even Web pages. An Authoring system is a program which has pre-programmed elements for the development of interactive multimedia software titles.

Authoring systems vary widely in orientation, capabilities, and learning curve. There is no such thing as a completely point-and-click automated authoring system; some knowledge of heuristic thinking and algorithm design is necessary. Authoring is actually just a speeded up form of programming without the intricacies of a programming language, but still requiring knowledge of how programs work. We recommend that all WBDE development teams include at least one person who can program lines of code. The limitations of the authoring software require that this team member be able to increase the authoring program's capabilities.

2.6.3.3 Testing

Testing is perhaps the most important phase in the design process and the one mostly overlooked. Testing can cover four areas: internal reviews, individual tryouts, small-group tryouts, and operational field tryouts. The purpose of the internal review is to verify the accuracy of the instructional materials as they are developed in order to identify inaccuracies and weaknesses in the materials so they can be corrected. There are many ways to review instructional materials for accuracy, completeness, and quality. The bottom line is to cross-check the materials against the data sources such as technical orders, regulations, directives, and checklists.

Individual tryouts help determine the effectiveness of small segments or units of instruction and materials as they are developed, updated, or revised. During this step, as the instruction and materials are being developed, they are tried out on individual students. The instruction and materials should be tried out on several students, to add validity and reliability to the data collected during the tryouts. It may not always be possible to conduct individual tryouts due to resource constraints.

Small-group tryouts, on the other hand, help determine if the instruction and materials work under conditions approximating the actual teaching-learning activity. In this stage, the instruction and materials are tried out on small groups of students if practical. Finally, operational tryouts help to determine if the instructional system actually works under operational conditions. They help gather feedback from a large sample of the target audience on which to base final revision or refinements to the instructional system prior to its becoming operational. Additionally, it helps work out any implementation or operational problems, such as equipment and facilities (Dept. of the Air Force, 1993).

All instructional design and development processes must include at least one type of testing or evaluation method described above. The evaluation mechanism will help attain the level of quality desired for the instructional product.

2.6.4 Implementation

Implementation includes the logistics and maintenance of the course. "Maintenance involves the continuous upkeep of WBE. It should begin during the analysis phase and be throughout the life of WBE. WBE is an intensive and delicate environment so it needs continual monitoring and care. During implementation, the instructor must be able to discern if the learner needs additional scaffolding, is running into 'dead ends,' or is using incompatible approaches or strategies. The learners hold primary responsibility for the learning process; but the instructor and designer are also responsible for creating an environment for problem solving to occur." (Hill & Land, 1998)

2.7 Stages and Timeline to implement the Web-based Distance Education alternative.

Poindexter and Heck (1999) have described Nine Levels of Integration for Web-based education:

Level 1 Goals - "Require Web research and references on projects or updated readings."

Level 2 Goals - "Encourage e-mail exchanges. Send announcements via e-mail to student address lists, accept e-mail file attachments for assignment submissions and drafts, and support student dialogue with group e-mail lists or discussion groups."

Level 3 Goals - "Develop a course Web site to centrally house various online functions and facilitate course management."

Level 4 Goals - "Utilize FTP and Web sites that contain software and demonstration models that can be run directly from the Web or downloaded to a student computer to run with local software."

Level 5 Goals - "Animate your lectures with multimedia. Models and demonstrations of current theories and practices can be run online during class time."

Level 6 Goals - "Establish online assessment tools and databases. Provide students with immediate feedback and instructors with Web site usage statistics."

Level 7 Goals - "Create a virtual laboratory in which animation and simulation replace physical experiments."

Level 8 Goals - "Develop a course that is deliverable either in part or fully online, and thus to remote locations."

Level 9 Goals - "Develop a remote laboratory. Enable students to set up the parameters that run an experiment from a remote location using the Web."

We recommend that the WBDE initiative at GSLIS be implemented at various stages. These stages are based on these nine levels:

Stage 1 (Levels 1 – 3) Web presence: All courses within the School should be able to use e-mail communications, have a Web site, and require Web research or references.

Stage 2 (Level 8) Course partially online: Most courses that will be offered via the Web should be able to have the majority of the coursework online.

Stage 3 (Levels 4-7) Course fully online: Using interactive multimedia tools and course management systems, most courses should be able to be fully online.

Stage 4 (Level 9) Development of remote laboratories: Stage four might be useful for preservation courses where virtual laboratories could substitute for in-person requirements. However, the technology and resources required to develop virtual laboratories are not available in the School at this point.

The stages described above can be implemented in the next five years as follows:

Time frame	**Stage**
As soon as possible	Stage 1
2000-2001	Stage 2 *
2000-2004	Stage 3
More than four years	Stage 4

*Within two years with current staff and technology resource constraints.

2.8 Evaluation and assessment of WBE effectiveness

To assess WBE effectiveness, four points should be evaluated:

① Quantity of learning achieved: Based on the success in widening access, especially in attracting specific target groups, drop-outs, the number of graduates as a proportion of the number of students admitted, and the time it takes students to graduate.

② Quality of learning achieved/quality of learning materials used: The extent to which WBE is a suitable vehicle for educating students in certain subjects; the extent to which education is provided as opposed to instruction; the effectiveness of learning at a distance, and the 'intersubjectivity' of learning through WBE.

③ The status of the learning achieved: The extent to which other educational institutions recognize the studies for credit transfer purposes; the acceptance of the degrees and diplomas awarded as qualifying students to go on to higher level studies; the recognition of awards by employers; and the esteem in which the WBE institution and their awards are held in the community at large.

④ The relative cost of the learning achieved: The cost-efficiency of WBE relative to traditional education; the cost-effectiveness of WBE relative to traditional education; the cost benefits of WBE and traditional university education, in which the costs of the education provided and the benefits to the individual and to society are taken into account; and the opportunity cost of education at a distance (Keegan and Rumble, 1982).

2.9 Recommendations

This section contains a summary of the instructional design recommendations provided throughout this section. The recommendations are based on the instructional design research and observations gathered in this document.

- Build more communication among the members of the School.

- Use an instructional design model to design all instruction, especially WBDE. Web-based instruction is completely different from the traditional lecture-based approach. For this reason, use an instructional design model that can facilitate the design of instruction.

- Use the team approach to design and develop courses. This will considerably reduce faculty and staff frustration, as well as project costs and development times.

- Use a majority of professional and semi-professional staff to reduce time and cost in designing and developing Web courses.

- Consider the skills of available people. Train faculty and staff in skills needed to design and produce WBDE

- Because WBDE assumes a more learner-centered approach in the classroom, it is very important that instructors use or be willing to use this strategy. Encourage instructors to try alternative instructional approaches that include a more learner-centered approach.

- For GSLIS to successfully implement WBDE, the School must encourage instructors to use technology in the classroom. If instructors are comfortable with technology, they will be comfortable with the technological aspects of WBDE.

- Use the data provided by this document to get an idea of the audience, the needs of the project, and the technical and content requirements for this project.

- Follow presentation guidelines appropriate for the screen when designing the content for WBDE.

- Test and revise at all stages of design and production.

- Use technology and media that support learning goals, domains and types of interaction. Do not use technology just for the sake of using technology.

- Consider learning styles and learner characteristics when designing instruction.

- Accommodate a variety of learning styles by using multimedia instruction when possible.

- Use media alternatives that are cost-effective and appropriate to the learning outcomes; do not use them simply because they are available.

- Use templates and standards when developing WBDE course.

- Use alternative and creative ways of evaluating student's accomplishment of learning goals.

- Use flowcharts, storyboards, and prototypes to communicate the ideas that will be presented in the WBDE course.

- Implement Web-based education in phases. This step-by step implementation will facilitate the transition from traditional instruction to WBDE.

- Evaluate the effectiveness of WBDE as a whole.