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COLLEGE OF EDUCATION: A GUIDE TO RESEARCHING
THE ANIMAL KINGDOM ON THE INTERNET

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Instructional Technology


by
Stephen Michael Williams
December 2004

COLLEGE OF EDUCATION: A GUIDE TO RESEARCHING
THE ANIMAL KINGDOM ON THE INTERNET

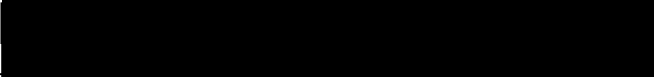
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Approved by:



Dr. Brian Newberry, First Reader



Dr. Eun-Ok Baek, Second Reader

Nov. 29, 2004
Date

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ABSTRACT

This paper describes the creation of a website designed for high school Biology students, which facilitates research on the Internet. The topic of research was the animal kingdom. After reviewing the related literature on learning theories, instructional systems design and Internet research, the method of design is discussed in depth. While reviewing the literature on Internet research, plagiarism was found to be a major issue. Methods of preventing plagiarism and focusing Internet research were incorporated into the overall design of the website. The design made it easy for students to identify the goals and expectations of the project. Scaffolding was also provided to focus their research, help prevent plagiarism and guide them step-by-step through the project. Science teachers were used to evaluate the content and usability of the website. They determined that the format was easy to follow and information was easy to access. Whether or not the website actually helps prevent plagiarism remains inconclusive.

ACKNOWLEDGMENTS

I would like to acknowledge my parents, Glen and Linda Williams for all their moral and financial support through both my undergraduate and graduate education.

I acknowledge Dr. Brian Newberry for his guidance through the thesis process. He is an excellent educator who practices what he preaches.

DEDICATION

This project is dedicated to my new baby, Faith Williams and my wife Sandy for her patience and understanding throughout this process.

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CHAPTER ONE

BACKGROUND

Introduction

An abundance of information is available on the Internet. Much of this information is more current than books in the library due to the fact that Internet content can be updated in minutes. This abundance of information as well as the ease of keeping it up to date is both a blessing and a curse for students trying to research topics on the Internet. The curse is that there is often so much information that it becomes overwhelming for students to choose what parts to use.

Statement of the Problem

Biology is the study of living things. As such, an understanding of biology is essential to understanding life itself. Schools are the primary place where biology is taught in a formal manner. Unfortunately, high school Biology students are often not provided with engaging and meaningful ways to learn biology, rather they still learn from a textbook or teacher lectures. These most often provide information that is dated, unexciting and unconnected to the real world. The Internet provides a

bridge to connect students to real world scientific information and research. Students should be able to apply current scientific information and research through the use of technology.

Purpose of the Project

This project sought to develop a website that would facilitate students' use of the Internet to research topics relating to the study of biology. This website serves as a bridge to link classroom topics to real world scientific information and research available on the Internet. It also serves as a guide to organizing research notes and works cited information. The topics for student research presented in this website are species of organisms within the animal kingdom.

Significance of the Project

Scientific information is too often presented through lecture and sometimes, outdated books. Through the use of the Internet, students are able to research the most recent information available on science topics. Every day scientific research yields new information about animals on Earth. Researchers are able to release that information much faster on the Internet than through publishing it in

a book. Internet search engines are efficient methods for obtaining information. Students can easily type in key words related to their topic and obtain instant lists of websites related to their topic. Viewing these websites allows students quick access to information. If a website is not useful, all the student needs to do is close the website and try a different one based on the search engine results. In comparison, library research can be extremely time consuming. In a library, students still need to search for keywords, but then they must hunt down a book to evaluate its usefulness. This efficiency also allows students to explore related information when using the Internet that would have not been pursued, due to time constraints, had they been researching in a library. Internet research does not completely replace library research, but it can help focus it. If keywords for topics have already been researched on the Internet and the student finds more information is needed on a specific topic, the student already has a very good idea of what they need to look for. Using the Internet first allows the student to spend less time in the library and more time working on their project.

Using the Internet is not without problems. For instance citing sources and plagiarism are two major problems that seem to appear with Internet research and digitalized projects. The Internet makes it easy for students to cut and paste content directly from websites into their projects. Even if students are not intentionally plagiarizing, they often forget where they found information on the Internet and fail to cite it. Students do this because so much information is available at their fingertips when researching using the Internet. This project has tools built into it that help prevent plagiarism and aid students with keeping track of their citations, as well as resources that help them with their final cited document.

Limitations

During the development of the project, a number of possible limitations were noted. These limitations were the following:

Secondary users were used in the evaluation of this project rather than the intended primary users who are students. Secondary users are high school science teachers. This choice was made due to time constraints and technology problems. It was not possible to completely

apply this project in the classroom. This project was an end of the year student project. On the second day of students using this website, a worm infected all school computers rendering them useless for two weeks. Needless to say, some modifications had to be made to the student project in order for them to complete the assignment without the use of technology. These changes defeated the purpose of this website. Fortunately, computers came online in the last two weeks of the school year. Evaluation of this project was subsequently conducted by the high school science teachers involved in the focus group sessions who were utilized in the design of this website. The advantage of using these secondary users was their familiarity with the content and potential application in their classrooms. The disadvantage was that the primary users, the students, did not evaluate the website. While the teachers tried to put their selves in the student's shoes during the evaluation, nothing beats the real thing.

Definition of Terms

Ambiguous Organizational Schemes - Ambiguous

organizational schemes do not have clear categorization rules (McCracken & Wolfe, 2004).

Class - A class is the third level of hierarchy in the biological classification of living organisms.

Classification - The biological classification of organisms, also called taxonomy, currently used contains seven hierarchical levels of classification. They are, from most general to most specific are kingdom, phylum, class, order, family, genus and species.

Hierarchical Organizational Structures - Hierarchical organizational structures categorize items based on their level or rank (McCracken & Wolfe, 2004).

Hypertext Organizational Structures - Hypertext organizational structures have links to additional content located within the existing text.

Instructional Design (ID) - "A systematic approach to creating training that meets the needs of the trainees and the organization while being as effective and efficient as possible (Piskurich, 2000, p.258)."

Instructional Systems Design (ISD) - "A systematic process of designing learning activities. By following ISD, designers increase the likelihood that their course designs will be appropriate and effective. The most basic form of the ISD model is a five-step process of analysis, design, development, implementation, and evaluation (Piskurich, p.259)."

Kingdom - A kingdom is the first level of hierarchy in the biological classification of living organisms.

Organizational Schemes - Organizational schemes are a way of classifying content items by putting them into categories (McCracken & Wolfe, 2004).

Organizational Structures - "An *organizational structure* determines the relationships between groups (McCracken & Wolfe, p.59)."

Phylum - A phylum is the second level of hierarchy in the biological classification of living organisms. The first level contains the six kingdoms of life.

Scaffolding - Scaffolds are support materials that are useful in understanding concepts.

Schemas - Schemas are "an internal representation of the world; an organization of concepts and actions that

can be revised by new information about the world
(WordNet 2.0, schema)."

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

The literature covered in this review includes learning theories as they apply to instructional design, instructional systems design and Internet based research. It is organized starting with theory and moving toward practical application of the theory. Behaviorist, cognitivist and constructivist theories are explored in the theory portion of the review. Instructional systems design focuses on The Dick and Carey, Gagné's Events of Instruction and Keller's ARCS Model of Motivation. While reviewing the literature on Internet based research, providing scaffolding and preventing plagiarism were found to be important aspects in designing a research based project. All the literature was selected to support the development of a web site that facilitates student research on the Internet.

Learning Theories and How They Apply to Instructional Design

Three philosophical theories have dominated education over the last one hundred years. These theories are behaviorism, cognitivism and constructivism. Behaviorists

believe learning occurs when the learner demonstrates the proper response, determined by an instructor, to a specific stimulus. Cognitivists focus less on the response to a stimulus and more on how the learner came to that response and why. Constructivists see learning as when the learner creates meaning from a particular experience (Mergel, 1998). Each of these theories has different implications with respect to how instruction is designed and how technology can be used to support learning.

Behaviorism

Behaviorists believe learning occurs when the learner demonstrates the proper response, determined by an instructor, to a specific stimulus. In *Instructional Design & Learning Theory: The Basics of Behaviorism*, Brenda Mergel (1998) describes the history of behaviorism, important researchers, and how they influenced educational technology. Behaviorists assess learning when the learner performs specific tasks. Instructors design their lessons based on measurable objectives. These objectives represent the specific tasks the learner needs to perform.

Instructional designers using the behaviorist theory spend a significant amount of their time designing objectives and determining how these objectives should be sequenced

for learning to occur. Bloom and Gagne both played significant roles in establishing taxonomic approaches to designing objectives (Saettler, 1990).

Technology in the behaviorist era was influenced by Skinners teaching machine method of instruction, which came to be known as programmed instruction (Saettler, p.295). Skinners method involved operant conditioning where students were reinforced for correct responses. Programs were designed and tested using operant conditioning in Denver in the 1960's, and the results showed mixed results. High achievers benefited by the technique, but low achievers did not. In fact the low achievers who did not use the programs did better than those who did (Saettler, p.298). Further studies revealed that classroom teaching combined with programmed instruction was more effective than each on their own (Saettler, p.299).

Cognitivism

Humans naturally possess skills for processing information. We use these skills to learn about our environment. Schemas are the mental models humans make using their experiences with their environment (Mergel, 1998). Cognitivists view the learning process as when a

learner changes or modifies their schema. Cognitive theory involves teaching students how to learn rather than teaching them how to meet a specific objective as in the behaviorist theory. The learner must play an active role in this process, because only the learner can change his or her schema. Cognitivists are less focused on the facts as instructional assessments, as they are to how the facts relate to the major concepts. When using cognitive teaching models, instructors attempt to transfer knowledge to practical applications (Wilson, 1993). One of the shortcomings of cognitive theory involves the assessment of cognitive structure. There is not a reliable way to evaluate the characteristics of memory structures (Wildman, 1981, p.19). Cognitivists must instead rely on evaluating how the learner applies knowledge in different contexts (Wilson, 1993).

Constructivism

Constructivists see learning as when the learner creates meaning from a particular experience. Behaviorists, cognitivists and constructivists all agree that the world is perceived by each person's interpretations of their own experiences. Constructivists differ in their view because they do not believe there is

any correct meaning to anything, because we all have different perceptions (Ertmer & Newby, 1993). The learner must be actively involved in the learning process as in the cognitivists view. Constructivists take things a step further than cognitivists. Constructivists see the learner elaborating and interpreting information given, rather than simply processing information. Instruction should be structured so that the learning is hands on and collaborative. The instructor acts as a coach, while the members of the group rely on each other's interpretations to come to a common goal (Wilson, 1997).

Which Theory Should Be Used?

Behaviorism, Cognitivism and Constructivism each have a place in today's educational environment. While categorizing behavioral objectives, both Bloom and Gagne developed a continuum for learning. Bloom's includes, in order: knowledge, comprehension, application, analysis, synthesis, and evaluation (Ertmer & Newby, 1993). Knowledge involves the lowest levels of thinking while evaluation involves the highest levels of thinking. Behaviorists tend to focus their instructional strategies on the knowledge and comprehension levels. Cognitivists focus on the application and analysis levels, while

constructivists focus at the synthesis and evaluation level. Looking at it this way, it is hard to imagine teaching effectively using any one of these theories on its own. When designing instruction the instructor needs to always consider that every student has a different schema for the topic of instruction. Some students may not have ever heard of a topic and have no schema at all for the topic. "What might be most effective for novice learners encountering a complex body of knowledge for the first time, would not be effective, efficient or stimulating for a learner who is more familiar with the content (Ertmer & Newby, p.67)." Instructional designers should consider the difficulty of the topic and students' prior knowledge before selecting the appropriate learning theory and applying its methods to instruction. In designing a unit of instruction, instructional designers can use methods of instruction based on different learning theories. Behaviorist theory can be used in the beginning of a unit for students to start building a knowledge base, use cognitive theory for students to start applying the knowledge to new applications, and ultimately conclude using constructivist theory to synthesize and evaluate material.

information to flow through at appropriate times. The gates facilitate systematic thinking in the midst of an often staggering number of variables designers attempt to control. (p. 136)

Various instructional design models have been developed that use the systems approach. Instructional Systems Development (ISD) is the term that encompasses the design models and the processes they represent (Dick et al., 2000).

Instructional Systems Development consists of five major parts. Those parts are analysis, design, development, implementation, and evaluation. When instructors are involved in the process of instructional design, they are utilizing the Instructional Systems Development process (Dick et al., 2000).

The Dick and Carey Model

"Instructional design models are based, in part, on many years of research on the learning process. Each component of the model is based on theory and, in most instances, on research that demonstrates the effectiveness of that component (Dick et al., p5)." One of the system design models frequently used by instructional designers is The Dick and Carey Model. This model is based on the

five phases of instructional design mentioned previously. Dick and Carey use nine major components in their instructional design model. Using The Dick and Carey Model, instructional designers will: assess needs to identify goal(s), conduct instructional analysis, analyze learners and contexts, write performance objectives, develop assessment instruments, develop an instructional strategy, develop and select instructional materials, design and conduct the formative evaluation of instruction and revise instruction. Each component is further described in the listing below:

- Assess Needs to Identify Goal(s)
 - Determine what the learners will be able to do after instruction is complete (Dick et al., 2000).
- Conduct Instructional Analysis
 - What pre-requisite skills do the learners need to begin instruction (Dick et al., 2000)?
- Analyze Learners and Contexts
 - What are the learners "current skills, preferences, and attitude (p. 7)?"

- What is available in the instructional setting? What type of materials does the instructor have to work with (Dick et al., 2000)?
- Write Performance Objectives
 - "(W)rite specific statements of what the learners will be able to do when they complete the instruction (p. 7)." These statements come from the skills identified in the instructional analysis.
- Develop Assessment Instruments
 - Assessment instruments are developed based on the behaviors described in the objectives (Dick et al., 2000).
- Develop Instructional Strategy
 - "The strategy will include sections on preinstructional activities, presentation of information, practice and feedback, testing, and follow-through activities (p. 7)." Here is where the instructor selects the medium to be used in instruction and the techniques identified by current learning theories and research.

- Develop and Select Instructional Materials
 - Based on everything accomplished in the first five steps, the instructor will design and develop the instructional materials used in the instruction (Dick et al., 2000).
- Design and Conduct the Formative Evaluation of Instruction
 - Here the instructor collects data that is used to improve the instruction. "Three types of formative evaluation are referred to as *one-to-one evaluation*, *small-group evaluation*, and *field evaluation* (p. 8)." Evaluation provides the instructor with information necessary to improve instruction.
- Revise Instruction
 - Changes to the instructional strategy and or the instructional materials are made based on the evaluation. At this stage the whole process must be revisited starting at the analysis to see what was missed. Evaluation, feedback, and revision are an important part of all instructional systems (Dick et al., 2000).

Users of the Dick and Carey Model of instructional design will use every phase of instructional systems design to its fullest. Instructors will not only need to understand what content needs to be taught, but also how the environment, instructor, materials and sequencing of materials will influence the learning process. A lesson, or unit designed using the Dick and Carey Model will evolve from year-to-year and class-to-class due to the revision process. As the instructor revises the lesson based on his or her previous experience, he or she may realize that the new group of students has different needs than the previous group, or that certain aspects of the analysis were missed the first time around. Instruction is modified and improved continuously.

Gagné's Events of Instruction

Based on the cognitive model of learning and memory, Gagné believes:

. . . behavior is assumed to be very complex and controlled primarily by a person's internal mental processes rather than external stimuli and reinforcements. Instruction is seen as organizing and providing sets of information and activities that guide, support, and augment

students' internal mental processes. Learning has occurred when students have incorporated new information into their memories that enables them to master new knowledge and skills. (Dick, et al., p.5)

Based on research, Gagné designed the Events of Instruction, which represent what the instructor or instructional designer need to do to make learning occur. The events can either be a result of an individual's personal interaction with learning materials, or due to the instructor's material selection and sequence of materials (Gagné, Briggs & Wager, 1992). The Events of Instruction are: Gaining attention, Informing learner of the objective, Stimulating recall of prerequisite learning, Presenting the stimulus material, Providing learning guidance, Eliciting the performance, Providing feedback about performance correctness, Assessing the performance, and Enhancing retention and transfer (Zemke, 1999). "In using the events of instruction for lesson planning, it is apparent that they must be organized in a flexible manner, with primary attention to the lesson's objectives (Gagné et al., 1992, p. 200)."

Keller's Model of Motivation

In order for learning to be achieved, the task must be meaningful to the students and be presented in a way that encourages success (Small, 1997). Using previous research on psychological motivation (as cited in Kruse, n.d.), John Keller created the Keller's ARCS Model of Motivation. The ARCS Model:

- [A]ttention strategies for arousing and sustaining curiosity and interest;
- [R]elelevance strategies that link to learners' needs, interests, and motives;
- [C]onfidence strategies that help students develop a positive expectation for successful achievement; and
- [S]atisfaction strategies that provide extrinsic and intrinsic reinforcement for effort. (Keller, 1983)

This looks like a condensed version of Gagné's Events of Instruction as mentioned in the previous section. The difference is that ARCS is focused solely on motivation, with the idea that if a student is motivated, then they are more likely to learn.

Different methods of motivation may be used while applying each component of the ARCS Model. Collaborative projects and different instructor presentation methods may be used to gain attention. "The easiest way to increase relevance is to allow students to take ownership of the learning experience, thereby vesting them in a learning experience with greater commitment to learning (Fernández, 1999, p.1)." "Allow students to develop confidence by enabling them to succeed. Present a degree of challenge that allows for meaningful success under both learning and performance conditions...(Kellers ARCS Model of Motivation, n.d., p.1)." Learners gain satisfaction by applying new knowledge or skills. This can be achieved if the instructor keeps the objectives consistent as well as the consequences for meeting those objectives (Fernández, 1999).

Internet Based Research

Scaffolding Project Based Curricula

While conducting research for projects, Marion Walton and Arlene Archer's (2004) students expressed difficulties with finding and referencing sources on Internet. Analysis found that most of their student's research was conducted individually, outside the classroom. Students searching

the web freely, on their own time, spent too much time searching and little time finding relevant information. Students had better results finding information in printed resources. As a result of this analysis, Walton and Archer (2004) conducted research and developed a scaffold approach to researching on the Internet. This scaffolding included activities for making queries using keywords, URLs linking to useful information on topics and "detective-hunts for information." The type and amount of scaffolding available varied with each task. The researchers moved some of their classes into computer labs and provided scaffolding to help aid student research on the Internet. Their scaffolding process started with objectives that were broken down into smaller parts allowing students to focus on one manageable task at a time. The scaffolding included, teaching strategies, web materials and ". . . curriculum structures that encourage participation in a community of enquiry-supporting students engaged in knowledge construction (p. 177)." An important aspect to the scaffolding is that it builds on what students already know. Students start off knowing some aspects of what they are doing. An example of their scaffolding can be shown in the tasks set for web

searching. Web searching was broken down into the following tasks where students would: formulate a research question, search for information, select relevant information, analyze information and then synthesize ideas based on the information (2004).

Walton and Archer (2004) found that "[s]tudents are likely to acquire web literacy if they are provided with a strong, meaningful framework that helps to focus their attention appropriately (p. 184)." They recommended that, ". . . evaluative criteria should be explicitly discussed, search tasks should be designed that lend students to discover helpful resources, and shared collaborative resources (such as our class bibliography) should be provided (p. 185)."

Plagiarism

Plagiarism was the topic most often discussed in the research on Internet based research. Studies (as cited in Davis, Grover, Beck and McGregor, 1992) conducted independently over the last sixty years have shown an increase in the rate of cheating on college campuses from 23% in the 1940's to a range of 40% to 88% (depending on the study) in the late 1980's. Jean Underwood and Attila Szabo (2003) conducted a study to determine if the level

of plagiarism in our universities has increased due to the Internet and the World Wide Web. They found that ". . . academic dishonesty in this technology-rich environment is a critical issue for Higher Education. In addition it shows that students are unsure whether staff are able or indeed willing to identify such behaviour (p.475)."

Today's technology rich society has made cheating and plagiarism much easier than it ever was in the past. Methods of cheating today include, but are not limited to: using word processors to cut and paste portions of documents directly from the Internet, using scanners to copy documents, and purchasing or downloading research papers from web sites on the Internet (2003).

Anglin & Carter conducted a study (as cited in Walton & Archer, 2004) on difficulties South African students had in obtaining academic literacy. Problems with referencing and plagiarism were used to judge these difficulties. Their study found that referencing problems were heightened when web sources were involved and plagiarism was apparent, however much of it was not with dishonest intentions. Another study conducted by Froese, Boswell, Garcia, Koehn, and Nelson (as cited in Landau, Druen & Arcuri, 2002) found that 48% of their students did not

know the proper methods for citing a source. While some plagiarism is completely intentional, much of it is due to students not completely understanding what plagiarism is and not knowing how to properly cite sources.

We want students to research to acquire new knowledge and make use of that knowledge. "A related goal is to teach students to respect and value the ideas of others and to use those ideas to enrich and complicate their own thinking (Leverenz, 1998)." Preventing plagiarism starts with the instructional design of the lesson. "Teachers should give clear directions for writing assignments, do spot checks of preliminary drafts, ask students to provide copies of documentation with their final paper and spot check citations (Galus, 2002, p. 35)." While students are conducting research, they should be required to keep a log of tools used and terms searched, including, the author, title, publication data, and page numbers, for proper reference information (Galus, 2002). Following these simple steps will not stop plagiarism completely, but they should cause a significant reduction in the amount of plagiarism that occurs. The students who are the unintentional plagiarists will have a better understanding of plagiarism and the instructor will have the opportunity

to encourage changes during the preliminary checks of the student's work.

Summary

Constructivist theory was the educational theory selected for this projects development. It was chosen because constructivist theory requires students to access the highest levels of learning. This project is an end of year project that requires students to synthesize and evaluate concepts previously learned throughout the year. Students are required to merge concepts in ecology with concepts in evolution. After focused research, the students will design and develop a website displaying what was learned. The Dick and Carey Model was the instructional design model used in the design and development process detailed in Chapter Three. Use of this model focuses the design around students' needs and encourages modification and growth of this project from year to year. Gangé's Events of Instruction were not ignored. It was determined through the literature review that Keller did an excellent job of simplifying Gangé's nine Events into the four steps in his ARCS Theory. Keller's ARCS Model of Motivation was utilized in the design and development of instructional materials as a way

to keep students interested in the lesson and finish with a sense of accomplishment as well as pride in their work. These materials included the scaffolding and techniques used to help prevent plagiarism. The literature reviewed for this project aided in the design and development of a website, based on methods of instruction rooted in constructivist theory, that helped focus student Internet research.

CHAPTER THREE

PROJECT DESIGN PROCESSES

Introduction

The design process used for this project involved analysis, design, development, implementation and evaluation (Piskurick, 2000). A focus group composed of high school science teachers was used in the analysis and evaluation portion of the design process. The purpose of the analysis was to determine the needs of the students, which were then used to determine the project goals. After the website was designed and developed, the focus group met again to test the usability of the website during the implementation stage of this project. Feedback from the focus group was used to improve the website. After final changes were made, the focus group met again to evaluate the final version of the website.

Analysis

Questions for analysis were developed to help with the initial focus group meetings (see Appendix B, Tables 2 and 3). Analysis helped determine that the website would be designed for high school students with adequate technology skills. Any technology used should be taught

prior to using this resource. The analysis also helped refine the goals of this website. The primary purpose of the website was to provide an interface to the Internet that allows students access to resources and research that was related to the content in the classroom. Plagiarism on research papers and projects was a concern among the focus group. To address this concern, the website was also designed to help avoid student plagiarism in their research project.

Design

Using the analysis as a guide, a basic design layout was determined for the website (see Table 1 and Figure 1).

Table 1. Outline of Website Layout

1. Home page
 - a. Welcome statement
 - b. Include e-mail link to instructor
2. Introduction page
 - a. A paragraph briefly explaining the scope of the project.
3. Requirement page
 - a. List student objectives and requirements for the project.

4. Tasks page

- a. List and describe the steps in the order they should be completed for students to complete their project.
- b. Links to sample documents. (All links open on new page)
- c. Create a table with anchors to each step on the top of the page and the bottom of the page.

5. Rubrics page

- a. Include any rubrics or grading instructions used for assessing student projects.

6. Links page

- a. Include useful links to help focus student research on the Internet.

7. Navigation Frame

- a. Frame should include a link to each of the above pages.

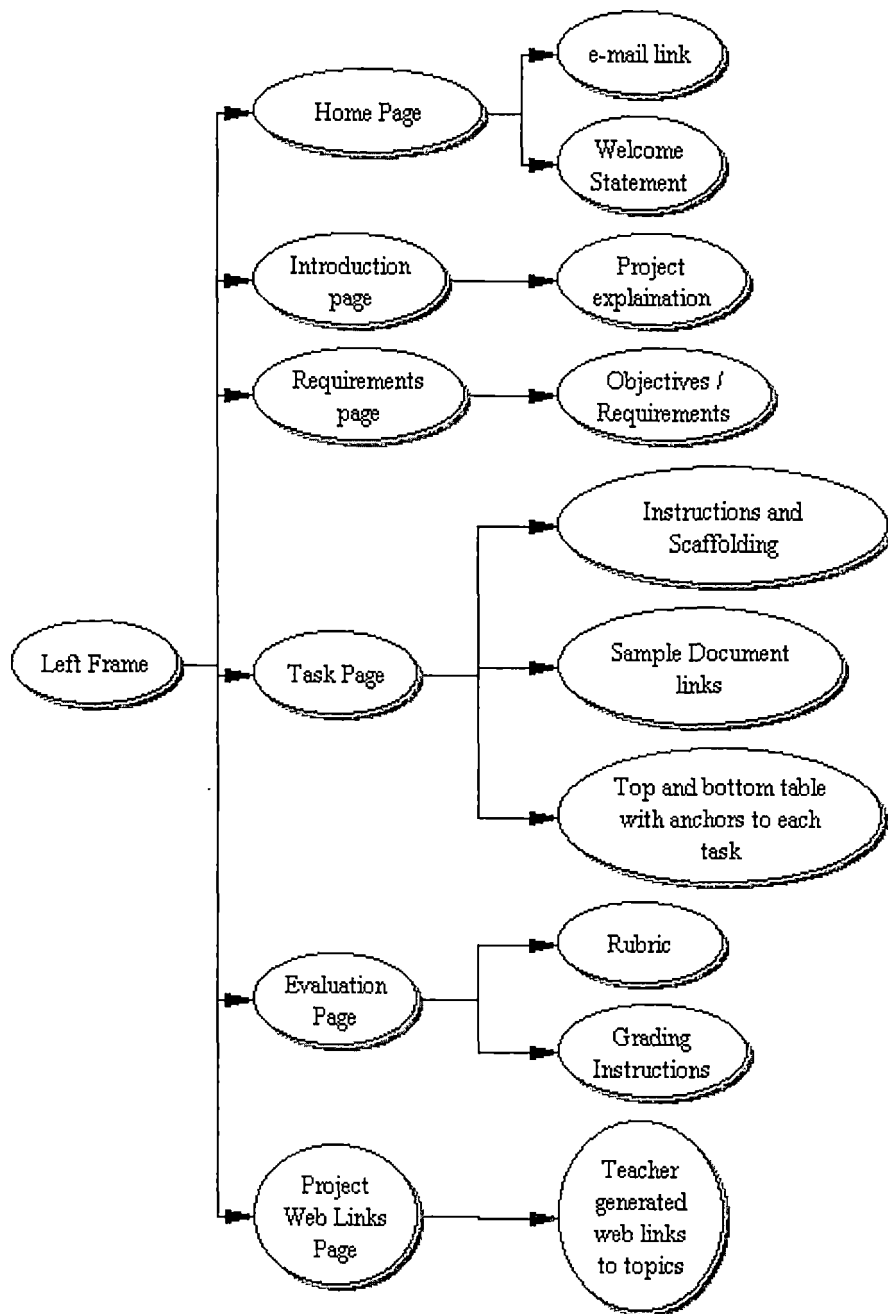


Figure 1. Graphical Outline of Website Layout

Instructional Objectives

Instructional objectives for this website were outlined in the requirements portion of this website. These objectives supported an end of the year research project. This website tied together the topics of evolution and ecology. Objectives were designed to fulfill the requirements listed in the California State Standards for Biology (2004). The instructional objectives were as follows:

- Students will identify five major characteristics of their phylum or class.
- Students will give examples of three different species within their phylum or class.
- Students will describe the habitat and niche of each of the three species.
- Students will draw out a taxonomic outline for one of the three species.
- Students will design a food web that contains at least one of the three species.
- Students will be given a choice of either describing one of the three species relevance to humans, reason for being an endangered species or mythological lore.

- Students will design a website using MS Publisher that includes all of the above objectives.

California State Standards

The California State Standards for Biology from the California Department of Education (2004) that were used in this project are listed below:

Ecology

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:

a. *Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.

b. *Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

(Ecology)

Evolution

7. The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. As a basis for understanding this concept:

d. *Students know* variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:

a. *Students know* how natural selection determines the differential survival of groups of organisms.

e. *Students know* how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction. (Evolution)

Keller's Model of Motivation

After establishing the content to be covered as defined by the California State Standards, a model for presenting the material in a coherent fashion was selected. This model was the Keller's ARCS Model of Motivation. The five parts of the model are attention, relevance, confidence and satisfaction. Each part of the theory is listed below with an accompanying explanation of how it was used in the design of this website:

- **Attention:** The home page contains a graphic organizer of the phylums and some classes within the kingdom Animalia. Pictures of organisms within each phylum or class are directly above the scientific name of the phylum. The graphic gains attention and stimulates inquiry. It gains attention because of its organization and pictures. It stimulates inquiry by showing relationships between organisms and introducing unfamiliar terms, which are paired up with pictures.
- **Relevance:** Prior to this project students experienced an activity where they had to classify or group shapes based on similar characteristics. The graphic helps tie in classification of shapes to classification of organisms. The introduction ties the project to topics we learned this year and the requirements page clearly states the objectives of the project.
- **Confidence:** This site is designed to generate confidence in the students by supporting their research. Tasks are clearly defined and resources are provided to help students in their

understanding of the tasks. A rubric is also provided that allows the students to clearly see how they are being graded.

- Satisfaction: A rubric helps students focus on accomplished objectives. Students have to keep a science notebook recording the notes for their research and a rough draft. Two grading periods are established to provide feedback before the final project is due. The first is the grading of the notes and the second is the grading of the rough draft. At each step the instructor can direct students to the rubric to help focus their research.

Student Activities

Student activities are identified in the task portion of this website. Each task is arranged to assist student research. Student tasks clarify and focus the student objectives.

Feedback

This project is designed to include multiple methods of feedback that assist the students. Notes are graded before the students start their rough draft and the rough draft is graded before the students can start on their

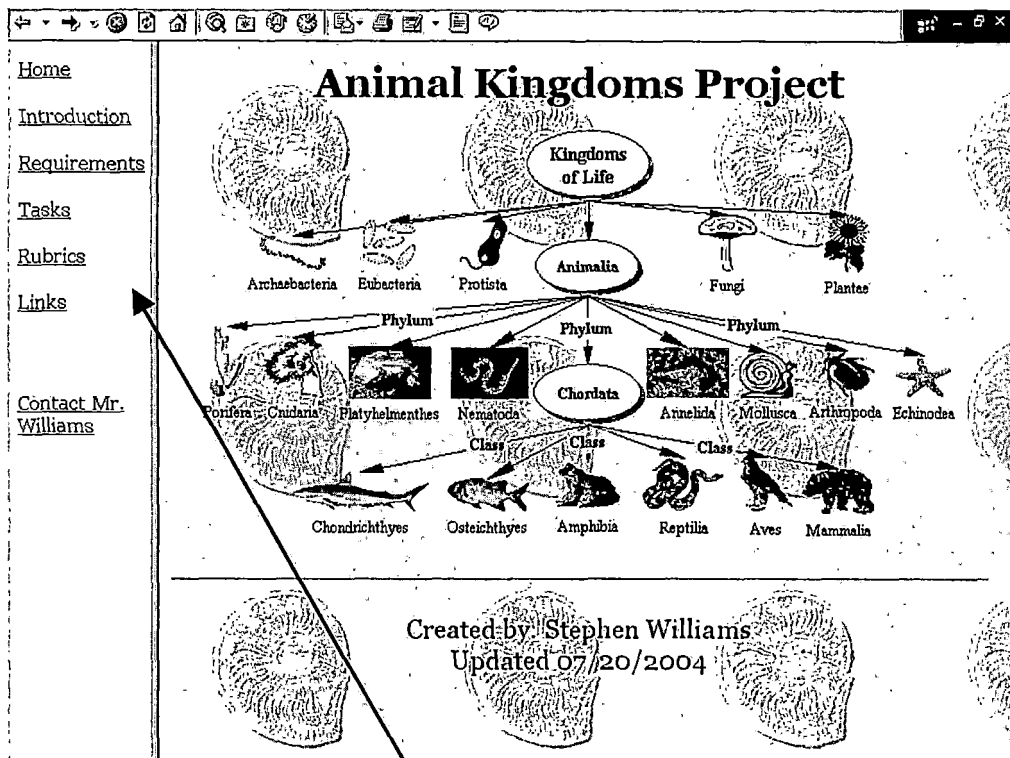
final draft. The first check is to make sure students followed note-taking instruction outlined in the task section and to check for understanding. This also enables the instructor to point students to specific parts of the rubric that may not have been addressed in the notes. The rough draft gives students another opportunity to receive feedback from the instructor and open up a dialogue for possible improvements. When the students complete the final project, the rubric is designed with three feedback columns. One is a self-evaluation, the next is a peer evaluation and the final is the instructor's evaluation. If students find the need for improvements during the self-evaluation or peer evaluation, time is given to make minor improvements.

Development

Content is organized by topic in an ambiguous organizational scheme. The topics are as follows: introduction, requirements, tasks, rubrics and links. Upon selecting a topic students will find information pertaining to that topic (McCracken, 2004).

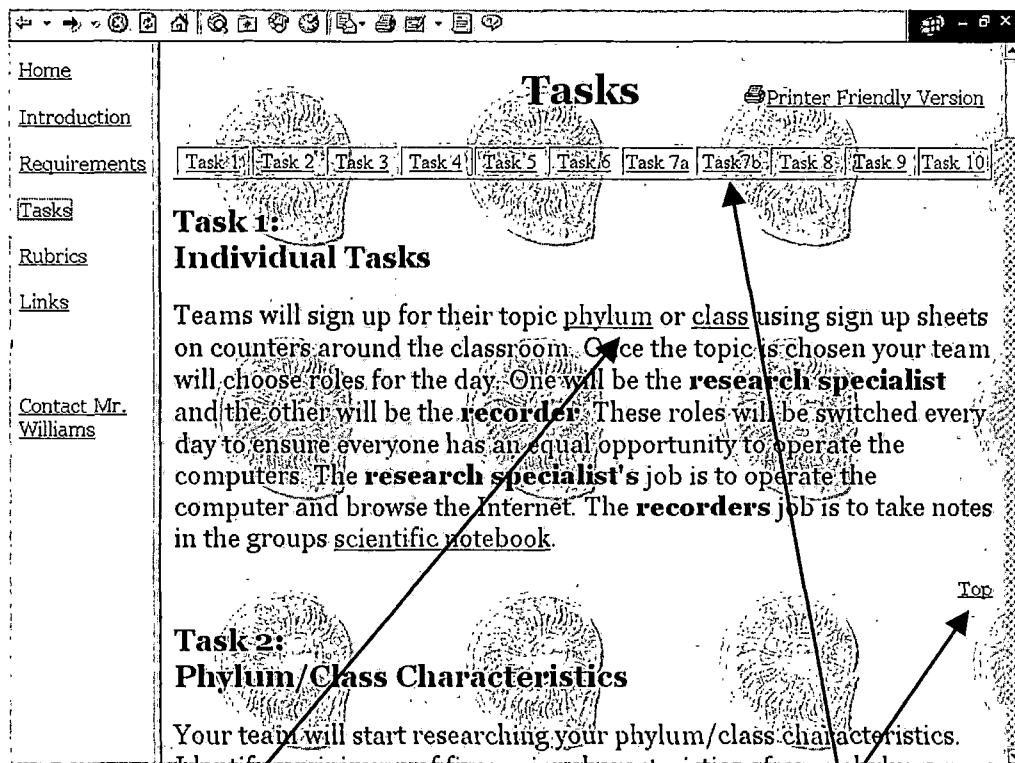
Two organizational structures were used to create this site. The primary structure is a hierarchical structure (see Figure 2) with a secondary hypertext

structure (see Figure 3). There are two to three levels of depth to hierarchical structure depending on the pages selected from the home page. A third level of depth is accessed via hypertext as demonstrated in the Figures 3 and 4. Students select a topic on the navigation bar from the home page, which brings them to their topical page. On the topic page, hypertext may be used to access the third level of hierarchy in the site (see Figure 3) (McCracken, 2004).



Note: The left global navigation bar demonstrates the first level in the hierarchical organizational structure.

Figure 2. Home Page

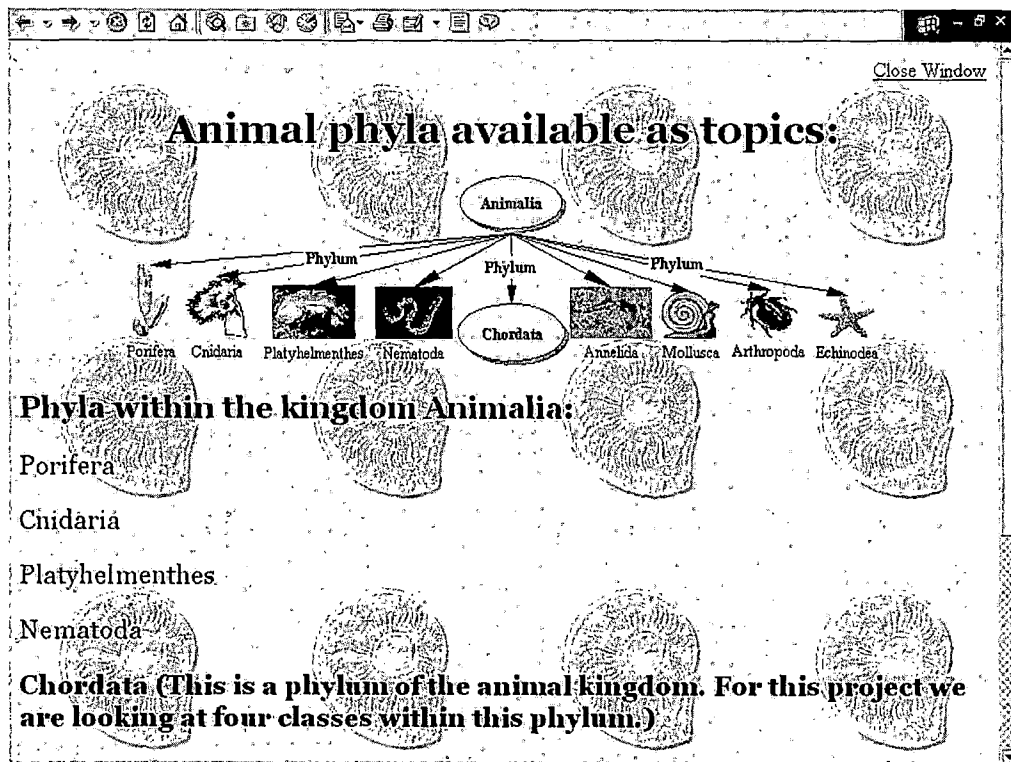


Second Level Navigation

Navigation Within Page

Note: The second level of navigation uses hypertext links located within the text of the page. Hypertext is used to access the third level of organization. On the Tasks page, shown here, hypertext is also used for navigation within the page.

Figure 3. Second Level Topical Page



Note: This page is within the last level of navigation. Third level pages were used as scaffolding to support information in the second level pages. They open in their own separate window. When closed the user returns to the last secondary page they viewed.

Figure 4. Third Level Page

A global text-based navigation frame is used to navigate through this site (McCracken, 2004). It appears consistently on the left side of the home page and all the second level pages of this site for easy navigation from one page to the next (see Figures 2 and 3). It is separated from the main frame by a thin border. Each page opens in the main frame of the website ensuring that the students never leave the website. When students reach the second level of navigation, they will come across hypertext added to support topics within the page. The hypertext links open informational pages in separate windows allowing the students to close these support pages when finished and return to the last page they were viewing.

Hypertext is also used to navigate within the tasks page. The task page is a very long page requiring the user to scroll up and down. To minimize scrolling, anchors have been added to each task with a navigation table at the top and bottom of the page (see Figure 3). At the end of the task a hyperlink is added to allow students to navigate back to the top of the page. This allows the student to navigate easily on a large page (McCracken, 2004).

Standard colors are used for simple text fonts and navigation buttons. This enables users to experience colors universally used for text and navigation on the Internet. Black is used for standard text. Blue is used for navigable text, while magenta is used for previously used navigation buttons. The background color is a light gray.

Light gray is used as the background color. The navigation frame has a plain gray background, while the main frame contains a graphic of an animal, which adds texture to the background. The textured background on the main frame helps with visual alignment between the navigation and mainframe.

Georgia is the font used for the majority of the website. This font was chosen because it is easy to read, like Times New Roman and because it was designed specifically for viewing on the screen of computers (McCracken, 2004). Different size fonts were used depending on where they were to be displayed. Primary headings have a font size of 24 points. Secondary headings have a font size of 18 points. Text within paragraphs has a font size of 16 points. Tables and text use for secondary navigation within a single page have a font size

of 12 points. All font sizes remain consistent across the website through the use of CSS style sheets. The only font on the website that differs from Georgia is the Freestyle Script that appears on the reference page for the student notebook. This was chosen because it simulates student handwriting. It is difficult to read, but the content is not important. The important part is that the students are reminded that notes for this project belong on paper, in their own handwriting, as opposed to typed in a Microsoft Word document.

Implementation

This project was designed using Dreamweaver and posted on an Internet server. Students will need to use a computer with an Internet connection and a web browser to access the website. A web-publishing program is preferable, however, there is a version of this project, available on the website that does not require a web-publishing program. This website was designed as a project implementation and research tool for students. It may be used in the classroom or as an individual assignment, at home, outside the classroom.

In the classroom

For use inside the classroom, students should be assigned to groups of two to three students. Two students per group are preferable. The instructor should briefly introduce the phylums and classes of animals that are the topics of this project. The home page can be used as a visual to help show students the different phylums and classes. Each student group can either have the opportunity to sign up for a phylum or class, or have a phylum or class assigned by the instructor. Each group should only have one phylum or class and no two groups should have the same phylum or class as a topic of study. After topics are chosen, the instructor can have students log on to the website and lead students through the introduction and requirements for this project. Then, students can start on their project using instructions located in the Task page of the website. Instructors will grade the notes when research is completed and the rough draft before students begin work on their final drafts. Upon completion of the project, if student websites were designed, the instructor can post the websites to a server for student access and in class presentations.

Outside the classroom

This website was designed to enable students to complete their projects individually outside the classroom with little help from the instructor. The project introduction and topic selection should be conducted in the classroom, but everything else can be completed individually as long as students have Internet access outside the school. A button on the navigation bar allows students to contact the instructor for support during the course of their project. Due dates for the notes, the rough draft and the final draft should be set so student work to be submitted to the instructor, checked, and graded at three stages of the students' projects. Once the final drafts are completed, the instructor can post student projects to a server for student access and in class presentations.

Participants in this study

All participants in this study were adult teachers currently teaching at Rancho Verde High School in the Val Verde Unified School District in Moreno Valley, California. Five teachers, who were currently teaching science, were selected as participants in the focus group. The participant's chosen were secondary users of the

instructional resource as opposed to the primary users, who were the students. Secondary users were selected for practicality. When the website was finally completed, School was in its last two weeks of session before summer. Secondary users were acceptable participants, because they were involved in the analysis stage of this project and could determine whether or not the objectives designed based on the analysis were met. These teachers will eventually be using this instructional resource in the classroom and were also able to evaluate whether or not it would be affective. Teachers evaluated the usability and content of the instructional resource.

Procedure for Field Test

Participants were given a list of seventeen website evaluation questions and statements (see Appendix B, Table 4). The researcher briefly explained that the purpose of the assessment was to evaluate two aspects of the instructional resource. First, it was to verify that the goals of the instructional resource were met. Second, was to see if the instructional resource was easy to use. It was also made known that any feedback would be used to improve the instructional resource. Instructions for each set of questions or statements were read, and then the

participants read each question or statement. The participants used the website to help answer the questions. As the participants used the website, the researcher took notes of their answers and observed their navigation process to check for problems. If they had difficulty answering a question, the researcher asked them to think out loud about what they were trying to do. If the participants answered no to a question, or rated a statement low, additional questioning was used to determine the source of the problem. Notes were taken on any verbal feedback they gave regarding each question. The very last question asked for any other comments and suggestions regarding the instructional resource that were not included in the usability questions.

Evaluation

All the participants thought the site was easy to use and were able to find the necessary content. One of the goals was to include an example of a works cited document. None of the participants could find the works cited document, due to the fact that an oversight caused this feature to be omitted on the tested version of the site. Two of the users made the comment that the method of completing the student project was only limited to

submitting a completed website. They suggested that the website include an alternative way for the students to submit a final project. Their reasoning was that more teachers would be willing to use this resource if their students did not have to make a website. Some teachers do not know how to build a website, and due to limited student access to computers, even with the know-how, this could be too difficult to accomplish. Two of the participants had difficulty finding the example of research notes, but eventually found them. They appeared to be skimming through the task portion of the website very quickly. Both participants mentioned that they probably would have found this without a problem, had they been students, actually required to complete the project. This would have forced them to read through the tasks carefully.

Due to recommendations made by the participants during the evaluation of the website, the works cited example and an alternative assessment were added. Students now have two options for the final research project. A website or a visual display can be completed to fulfill their requirements. This option led to the addition of optional tasks and an additional grading rubric.

Summary

This website was designed to facilitate student research on the Internet. The design process used to produce this website was a five step process involving assessment, design, development, implementation and evaluation. Research in learning theories and motivation theory played a part in the design and development process. Focus groups were used to assist in the analysis and evaluation parts of the design process. Modifications in the design resulted from feedback during the evaluation stage of the design process.

CHAPTER FOUR

CONCLUSIONS AND RECOMENDATIONS

Introduction

Designing and developing an instructional website is challenging, yet worthwhile and rewarding. As the technology needed to create such websites becomes easier to us it will be possible for more teachers to replicate this development activity in many different content areas. This summary presents the conclusions developed as a result of completing the project which might inform others wishing to undertake similar development projects. Further, the recommendations extracted from the project are presented. Lastly, the chapter concludes with a project summary.

Conclusions

Participants using the website performed well over all. Project requirements, grading rubrics, tasks and scaffolds were usually easy to locate. Because the participants were not students performing the actual tasks required to complete the project, some rushed through the site very quickly, occasionally missing items discussed in the usability assessment. Even though they seemed rushed,

all the content was eventually found. Had actual students been used as test subjects, some of the most valuable feedback would have been omitted. That feedback included the comments about adding an optional assessment for the students, so they were not limited to only submitting a website as a final product.

One important item not addressed during the evaluation of this project was the issue of plagiarism. Part of this project and its design was centered on preventing plagiarism during this research project. Theories and practices mentioned by researchers in the literature review were implemented in the design of this website, but not tested. The features included in the website, based on research, that were intended to prevent plagiarism included: clear directions for the assignment with supporting scaffolding; requiring students to take handwritten notes that include the author, title, publication data, and pages cited; instructor grading of notes; instructor grading of project rough draft. How effective this website is in preventing plagiarism cannot be determined until it is implemented in a classroom setting with actual students.

Recommendations

Further research can be conducted to see if the structure of tasks and scaffolding in this website actually help prevent plagiarism on Internet based research projects. A different version of this website would need to be designed to serve as a control group. In designing the website for the control group, the researcher would need to remove the scaffolding and tools mentioned in this project as helping prevent plagiarism. Having students hand write notes in a specific format is one of the tools used in this project that help prevent plagiarism. In a control group, the researcher could allow the students to simply take notes, without any specific requirements for those notes.

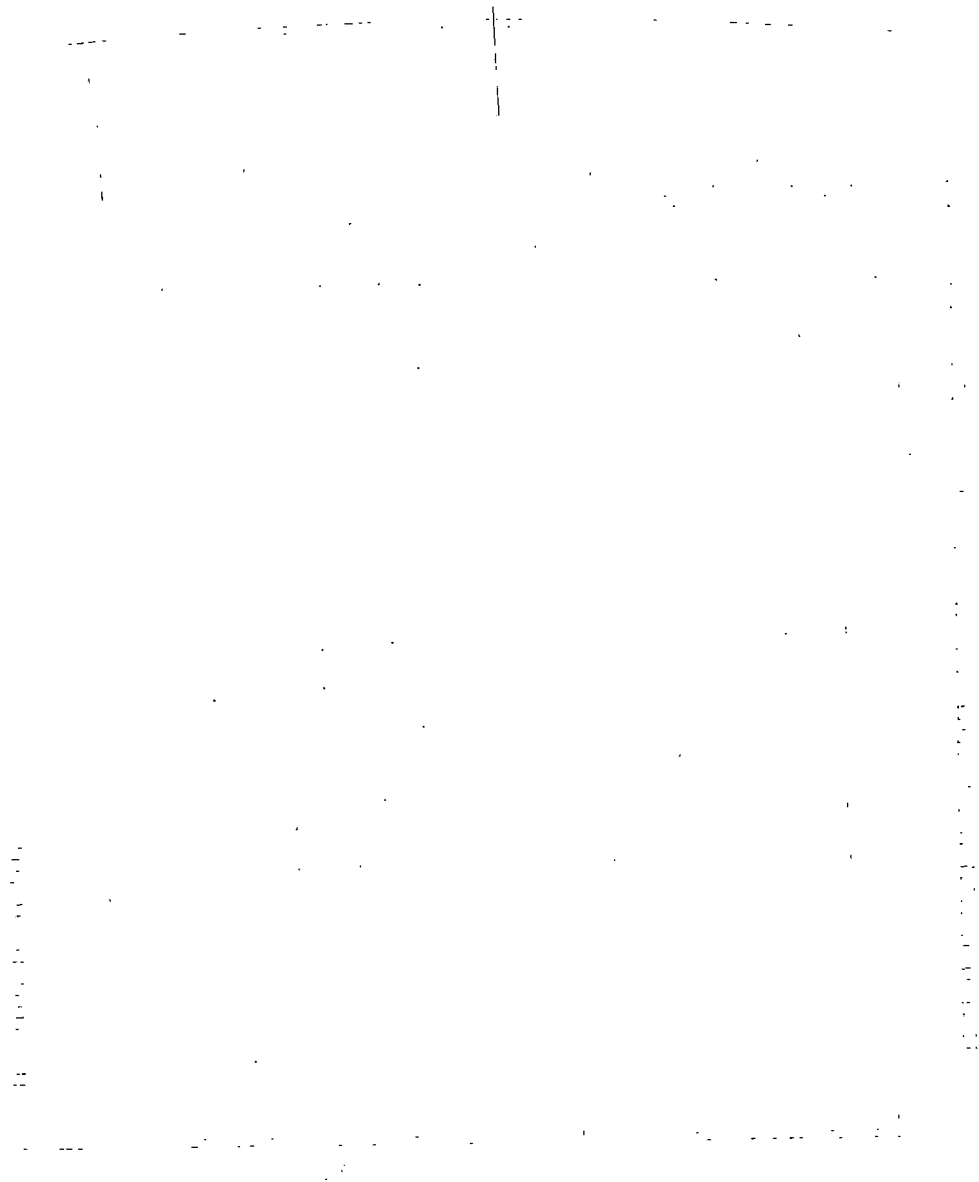
Another recommendation is to be flexible with the use of this website. The purpose for its design was to connect students to real world events and research by using the Internet. This website can actually be used as a template for any Internet based research project. The current design involves science standards and the animal kingdom, but it could easily be adapted for any topic in any subject area.

Summary

With the use of the Internet, students are able access information available in multiple mediums regarding almost any topic they can imagine. Due to the abundance of content and the ease of accessing that content, students are often overloaded with information and have difficulties sorting it out and making proper references. During the course of this project, a website was designed to help guide students through an Internet based research project focused on the animal kingdom. The design made it easy for students to identify the goals and expectations of the project. Scaffolding was also provided to focus their research, help prevent plagiarism and guide them step-by-step through the project. Science teachers were used to evaluate the content and usability of the website. They determined that the format was easy to follow and information was easy to access. Whether or not the website actually helps prevent plagiarism remains inconclusive.

APPENDIX A
CD OF PROJECT

CD OF PROJECT



APPENDIX B

TABLES

TABLES

Table 2. Analysis Questions

- Who is to be taught?
 - What type of instruction in using technology have students had?
 - What experiences with using technology have students had?
 - What are student's current technology skills?
- What is to be taught?
 - What is the topic?
 - What are the goals?
 - What should high school students know about scientific research?
- How will learning (success) be measured?
 - How is student learning currently measured?
 - What evaluation methods exist that assess higher levels of learning?
- How will the material be taught?
 - What kind of resource (instructor, technology) do we, the instructors, have?
 - How many students will there be?
 - Are the students in the same location for instruction or are they scattered?

- o How much time do students have for instruction?

Table 3. Analysis Questions With A Summary of Focus Group Answers

- Who is to be taught? (High school Biology students)
 - o What type of instruction in using technology have students had?

Answer: Students have been instructed in Word, Excel, Inspiration, PowerPoint, Publisher and basic Internet research.
 - o What experiences with using technology have students had?

Answer: Students have used Word, Inspiration, PowerPoint, Publisher and Internet research.
 - o What are student's current technology skills?

Answer: Students have demonstrated the ability to use Word, Inspiration, PowerPoint, and Publisher.
- What is to be taught?
 - o What is the goal?

Answer: For students to integrate current scientific information and research into their learning experience.

- A: For students to organize research notes and properly cite sources.

- o What is the topic?

Answer: Taxonomy and Internet Research

- o What should high school students know about scientific research?

Answer: Students should know how to do basic Internet searches using search engines.

- A: Students should know not to plagiarize and that they need to cite sources used in researching topics, but some students are still having problems with plagiarizing, especially with web based research
- How will learning (success) be measured?
 - o How is student learning currently measured?

Answer: Rubrics based on standards and objectives.

- o What evaluation methods exist that assess higher levels of learning?

Answer: Students will design a project (Power Point or Web Page) graded with a rubric.

- How will the material be taught?
 - o What kind of resource (instructor, technology) do we, the instructors, have?
- A: Laptop computers connected to my website via a broadband connection. MS Word, MS Excel, MS Publisher, MS Explorer and Inspiration are available to the students.
- A: Use of the Internet and MS Publisher are mandatory for this project
 - o How many students will there be?

Answer: Able to support 2-3 students per computer with up to 36 total students. Limited availability does exist for 1 student per computer in the computer lab.

- o Are the students in the same location for instruction or are they scattered?

Answer: Students are in one science
classroom.

- o How much time do students have for
instruction?

Answer: 50 min periods. The number of days
is up to the instructor.

Table 4. Evaluation Questions for Content Access and
Usability

Content Access

**Instructions: Please answer the following questions.
Yes and No answers are acceptable.**

- (1) Can you locate the requirements for this
project?
- (2) Where can you locate instructions for this
project?
- (3) How will this project be graded?
- (4) Where can you locate websites that will
support the student's research?
- (5) Where can students find an example of
research notes?
- (6) Where can students go to find an example of
a works cited document?

Usability

Instructions: Answer the following statements with either Yes/No answers, or rank the statement on a 5 point scale, 5 being best, and 1 being worst.

- (7) Major/important parts of the site are
directly accessible from the main page
- (8) Essential functions are available without
leaving the site
- (9) Site reflects user's workflow
- (10) Related information or tasks are grouped:
 - (a) on the same page or menu
 - (b) in the same area within a page
- (11) Site is designed to require minimal help
and instructions
- (12) Users can receive e-mail feedback if
necessary
- (13) Link reflects the title of the page to
which it refers
- (14) Site is organized from the user's
perspective
- (15) Colors used for visited and unvisited links
are easily seen and understood
- (16) Font is easy to read

(17) Write in any additional comments or
questions regarding the content, layout or
usability here:

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