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Interenet research strategies used by students during phases of the learning cycle

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INTERNET RESEARCH STRATEGIES USED BY STUDENTS DURING PHASES OF THE LEARNING CYCLE

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ABSTRACT

INTERNET RESEARCH STRATEGIES USED BY STUDENTS DURING PHASES OF THE LEARNING CYCLE

by Stephanie Steinbeck

This thesis addresses the topic of Internet use as a research tool during the Learning Cycle phases of: exploration, generalization/clarification, and application of knowledge. The study explores (1) strategies used by third grade students during each phase, (2) the relevance of student collected information, (3) the extent to which the information is used for further research, and (4) at which phase of the Learning Cycle computer-based research is most effective based on the depth of student-gathered information. Published literature, observation notes, and student work were analyzed for patterns and trends. The results of the study revealed the importance of building prior knowledge of the topics being studied, before using the Internet during the exploration phase. Students were able to locate a greater number of sites relevant to the research topic during the generalization/clarification stage. Research reports produced by students during the application phase reflected the depth of information gathered.

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CHAPTER I

INTRODUCTION

Computer use as an educational tool is widespread in our educational system. As our nation advances into a world of cyber-communication, students will be expected to learn and implement a wide variety of computer skills. What is not so clear is how and when educators should implement computer education and assess the knowledge students acquire through computer assisted instruction (CAI), and computer based research.

The way in which individual students learn will impact their use of the computer as an educational tool. Matusevich (1995) argues that software packages focusing on skill and drill techniques are essentially the same methods used in the traditional classroom, and are therefore not appropriate use of technology if the goal is to take a constructivist or hands-on approach to learning. If the present system is failing to produce the type of educated students that the nation needs, then automating those same processes will not change the educational outcomes. Having students learn superficial information faster will not improve the quality of education. According to Fisher, Dwyer and Yocam (1996), the decade from 1985-1995 can be viewed as the first period of widespread use of personal computers in schools. Ways in which computers are used vary greatly, and thus the educational outcomes of our nation's students as a whole will be inconsistent. Students as well as educators are at varying levels of computer based training and accessibility. From computer assisted instruction to research based implementation, assessing the computer's impact on the quality of education has been a challenge for educators.

Statement of the Problem

Knowing how to best implement the computer as an instructional tool is a challenge confronting most educators. Compared to research in traditional methods of instruction, research in computer-based learning, and how and when it is best implemented, is limited. Advocates of technological innovation often seem to focus their attention on the technology itself and on the goals they believe the technology can accomplish. However, it is what students do with the machine, not the machine itself that makes a difference (Giacquinta, Bauer, & Levin, 1993). At what stage of the Learning Cycle, exploration, generalization/clarification, or application of knowledge, will use of the Internet for research be most advantageous? Is a student's success dependent upon their Internet navigational skills? Knowing how and when computer use is most effective may assist educators in improving computer based research and instructional programs.

This study focuses on the research strategies students use during the Learning Cycle phases, and how their acquisition of knowledge throughout the phases affects the amount of valid information obtained from Internet searches. It is the author's contention that students will spend more time using the Internet to gain knowledge during the exploration phase if they are given prior knowledge of the topic. Without prior knowledge, students will stray off the given topic and may get lost in the WWW while seeking information. While using the Internet in the generalization/clarification stage students will spend more time on-line seeking relative information and may explore topics related to the given research topic. The application stage will show students going beyond the topic, wanting to explore related subjects and perhaps using non-computer based strategies while implementing their

knowledge.

Significance of the Problem

How to assess what is learned in a computer-based learning environment is not always straight forward. An assignment in which students are asked to use the computer to gather knowledge, relate the knowledge to current mind sets, and implement new knowledge gained through additional or extended inquiry is open ended and requires individualized assessment. Noting the direction that a student chooses to pursue research may be as important as achievement. Prior knowledge of the subject, social and/or cultural backgrounds, and experience conducting research are just some of the factors that can influence knowledge acquisition and research abilities. Effective instruction, lesson design and clear assessment criteria are key to student success. Knowing at which point in the Learning Cycle phases a student's computer use is most advantageous can assist educators and curriculum developers to create appropriate computer-based lessons.

Purpose of the Study

The purpose of this study is to gain insight through the Learning Cycle Model of education to determine if there are patterns of Internet use during the stages of exploration, generalization/clarification, and application. Patterns of use can assist in determining when in the Learning Cycle students should engage in computer-based research to attain optimal success in finding information related to their topic of inquiry.

Research Questions

The following research questions were addressed in this qualitative study:

1. Is there is a pattern of research strategies used by students at the different stages of a Learning Cycle?
2. What prompts students to choose some pathways over others?
3. Will students be more successful acquiring relevant information from the Internet if given prior knowledge of the topic?
4. Are Internet navigational skills a factor in the quantity and depth of information gathered?
5. Is the key to a successful student-research experience connected to how and when the Internet is used during the particular phases?

Assumptions of the Study

The following assumptions were made:

1. Subjects in this study have had similar exposure to school-based computer use while attending the elementary school from kindergarten.
2. Interest in the topic being researched, Arctic animals, will encourage students to implement and enhance research strategies.
3. The Learning Cycle Model is applicable to each student's individual learning style.

Limitations of the Study

Conditions for the study included the following restrictions:

1. The research participants included students with a variety of home-

based computer skills in addition to the standard school-based computer instruction beginning in kindergarten.

2. Observations were carried out during a period of six weeks for approximately two hours per day.
3. Computer use by subjects outside the classroom was not monitored and may have affected developing skills.
4. Each participant conducted research on a different Arctic animal. Availability of information, therefore, was not consistent.

Delimitations of the Study

For the purposes of conducting this study, the researcher imposed the following restrictions:

1. This study was limited to one elementary school in the San Jose region.
2. The sample size was limited to six students in one classroom. Results from four of the six students were documented.
3. Student selection for the study was based on parental consent.
4. It was not a function of this study to compare ethnic, cultural or gender differences associated with computer use.

Definition of Terms

CAI: Computer Assisted Instruction

Cache: Computer memory holding recently accessed data, designed to speed up subsequent access to the same data. This storage mechanism allows Internet sites to be accessed quickly and to be tracked to determine frequency and duration of usage.

Constructivism: A teaching philosophy supported by John Dewey, Vygotsky and Montessori (Henze & Nejdl,1998) in which the teacher acts as a facilitator, or coach to the students. The Contructivist theory states that students learn best when allowed to actively formulate or construct understanding for themselves based on their experiences.

Higher Order Thinking Skills: Critical thinking skills requiring students to manipulate information and ideas in ways that transform meaning and implications such as when students combine facts and ideas in order to synthesize, generalize, explain, hypothesize, or arrive at some conclusion or interpretation (Vockell & Van Duesen,1989).

Hits: A single request from a web browser for a single item from a web server. Successful matches are presented as a list of site titles relating to keywords or phrases entered into a search engine.

Hyperlink: An element in an electronic document that links to another place in the same document or to an entirely different document. Typically, you click on the hyperlink to follow the link. Hyperlinks are the most essential ingredient of all hypertext systems, including the World Wide Web (Enzer, 1994).

Keywords: In text editing and database management systems, a keyword is an index entry that identifies a specific record or document. Words or phrases entered into a search engine are used to obtain hit lists.

Learning Cycle: A cycle moving learners through investigation by allowing them to explore materials, construct a concept, and to apply this concept to new ideas. The student is at the center of the learning experience, with the teacher encouraging the process. This study focuses on the following three stages:

- exploration of topic or concept
- generalization/clarification of information
- application of knowledge

Learning Styles: A process of learning focusing on how individuals absorb information, think about information, and evaluate the results. Examples of learning styles are kinesthetic, visual, and auditory learners (Silver, Strong, & Perini, 1997).

Metacognitive Skills: Strategies enabling learners to be aware of their own thinking and to use this awareness to improve their performance.

Multiple Intelligences: Howard Gardner (1997) cites eight human intelligences centering on the content and products of learning. Students may exhibit characteristics from each of the following:

1. Linguistic-verbal acuity
2. Logical/Mathematical
3. Spatial
4. Musical
5. Bodily kinesthetic
6. Interpersonal

7. Intrapersonal

8. Naturalistic

Research Techniques: The use by students of word processing, accessing encyclopedia CD Roms, Internet navigation buttons, and multimedia authoring software to gather information. Students were familiar with collecting information electronically, and through the traditional methods of text-book research. They had prior experience in organizing information into a written report as an end project.

Robot: An automated program using hypertext links to move from web page to web page and site to site retrieving information and creating databases of references for search engines. Also known as Web Wanderers, Web Crawlers and/or Spiders according to the Lycos Help Page (as cited in Pratt, 1999).

Search Engine: A program that searches documents for specified keywords and returns a list of the documents where the keywords were found. This enables Internet users to search for documents on the World Wide Web. A search engine works by sending out a spider to collect as many documents related to the keywords as possible. Examples of search engines are Infoseek, Yahoo, Lycos, Alta Vista, and Excite. Most search engines find files that contain a keyword or phrase typed in by the user (Internet.com, 1999). This information is then presented as a list of hits.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The purpose of this study is to investigate the comparative effectiveness of computer based research during the phases of the Learning Cycle Model of education. In order to assess at what point computer based research is most affective in attainment of knowledge, The following questions were addressed:

1. Is there a pattern of research strategies used by students at the different stages of a Learning Cycle?
2. What prompts students to choose some pathways over others?
3. Will students be more successful acquiring relevant information from the Internet if given prior knowledge of the topic?
4. Are Internet navigational skills a factor in the quantity and depth of information gathered?
5. Is the key to a successful student-research experience connected to how and when the Internet is used during the particular phases?

This literature review will address the history of computer-based learning and instruction in the educational system, how this instruction addresses student learning styles and intelligences, and the role of technology in a constructivist learning environment. Educational standards for technology use and assessment strategies for computer-based educational settings will also be reviewed.

Computers in Education

Computers promote self-directed learning, central to the constructivist model of education. Students become empowered by gaining access to real data and working on problems or projects which are personally meaningful. Effective uses of technology in a constructivist setting include interactive software, hypermedia, and Internet research. With these tools, students can be self directed with an active role in their knowledge acquisition (Howley & Meadows, 1998).

The last twenty years has brought a technological revolution which has penetrated every aspect of society. Hawkins (1996) contends that people do not learn much, or much of lasting use and significance, solely through direct transmission of information from persons, texts or technologies to learners. He outlines the following features to be indicators of a successful learning environment:

- Active engagement in meaningful tasks
- Being well known by teachers, peers, faculty
- Intense coaching to help students recognize their potential
- Carefully designed and sustained collaborative interactions among small groups of learners
- Being inspired by or drawn into new ways of thinking
- Access to many and varied resources

According to Hawkins' study, the introduction of microcomputers and multimedia systems has been seen by many as a way to solve many educational problems. Educators believed that these technologies would lead to individualized learning, more intense and faster learning through new cognitive tools, and emphasis on small group and individual inquiry as

opposed to lecture and rote exercises. Despite the variety of available materials and the models for implementation, Hawkins found that the technologies were far more commonly appropriated to the way knowledge is traditionally administered, as rote exercises focused on memorization of information.

According to Vockell and Van Duesen (1989), the computer has considerable potential to help students develop higher order thinking skills. Higher order thinking skills (HOTS) are the strategies that enable learners to be aware of their thinking as they perform tasks and to use this awareness to improve their performance on those tasks. The absence of these metacognitive skills may be responsible for failures to learn from attempts at thinking. Vockell and Van Duesen found that students learn to think through such activities as writing research papers, collecting, analyzing, and categorizing information, and discussing issues with teachers and classmates. These traditional techniques still play an important role, and by using computers, students can perform these tasks more efficiently. Using a computer permits students to spend more time on the actual thinking tasks rather than on the peripheral activities such as locating reference materials from multiple sources. In the area of research, the computer allows students to collect and revise work more quickly, allowing additional time for critical thinking about the topic. In this case the computer does not directly teach higher order thinking skills, but it directly enhances the development of HOTS by making it possible for students to spend their overall time more effectively (Vockell & Van Duesen, 1989). Using the computer, students can practice skills tailored to their own needs, work at their own pace, receive immediate or corrective feedback, and repeat processes as often as necessary.

The Apple Classrooms of Tomorrow (ACOT) was a ten year project where students and teachers were supplied with computers for home and school. Dwyer illustrates (as cited in Kosakowski, 1998) some gains made in students' advanced skills. ACOT reports that students:

- Explored and represented information dynamically and in many forms
- Became socially aware and more confident
- Communicated effectively about complex processes
- Became independent learners and self starters
- Worked well collaboratively
- Knew their areas of expertise and shared expertise spontaneously
- Used technology routinely and appropriately

Given the skills and opportunity to use the computer in self guided endeavors can enhance students' self esteem and increase positive attitudes towards self and others. Positive effects of on-line technologies were found in a study conducted by the Center for Applied Special Technology (as cited in Kosakowski, 1998) showing significantly higher scores on measures of information management, communication, and presentation of ideas for experimental groups with on-line access than for control groups without Internet access. In addition, students in the experimental group reported increased computer use in the areas of information gathering, organizing and presenting information, doing multimedia projects, and requesting help with basic skills. The Internet has provided ease of communication, prompting increased use of the computer for activities promoting students' cognitive growth.

Based on a study by Owston (1997), the World Wide Web (WWW) appears to offer at least three distinct advantages that can be used to promote

improved learning. The first advantage is that the WWW compliments the students' learning experience. Children of today have always had computers. They play, are entertained by, and learn with the computer. Today's students tend to be more visual learners than previous generations because their world is rich in visual stimuli (Owston, 1997). It is fitting that educational institutions design learning materials and methods for instruction that capitalize on what we know about how students prefer to learn. The Internet offers a world of visual stimuli making the task of research seem more exciting when done via the Internet than through more traditional avenues such as textbook research. According to Windschitl (1998), the visual and auditory characteristics of the WWW appeal to a variety of learning styles and have been shown to elicit student interest. The rich imagery associated with many Web pages is another data source that learners can exploit for inquiry. Owston claims that there is promising indication that the world wide web is a possible vehicle for increasing access to education. Evidence of how it can promote and enhance learning is not as apparent.

Windschitl (1998) contends that educators and researchers should distinguish between the effects of using technology and the effects of using information, as well as the difference between accessing information and having a learning experience. If the educators' goal is to maximize the possibilities for student learning with technology, this requires a critical examination of the educational content of information technology, pedagogy and learning. Traditionally, students have worked as individuals to acquire knowledge from resources such as texts and teachers for the purpose of performing well on objective assessments. Another concept of learning is students working collaboratively on multidisciplinary tasks using a variety of

resources, constructing their own knowledge for the purpose of developing understandings of subject matter. The Web, like other tools can be used to support both visions of learning. According to Windschitl, the volume of diverse information available for downloading and/or inspection and the wealth of visual information should promote a richer inquiry experience for learners, especially in the typical classroom where traditional resource materials do little to stimulate students' interests. There is such a volume of information available on the Web that if learners can identify a meaningful inquiry question in any subject area, they are likely to find a significant body of associated information. While volumes of valid information exists, the Web also contains misinformation which must be recognized disproved Windschitl, 1998).

Web 66 is the University of Minnesota's College of Education Web site. This site lists over 6,600 schools in nearly sixty different countries ranging from kindergarten to grade twelve that have their own web home page. Student work, classroom information, and e-mail access are some of the features presented on the school and classroom home pages. The world wide web is used by students and educators in a variety of ways.

The second advantage computers offer to education is the flexibility of learning provided by the Internet. On-line courses are available through many universities allowing for distance learning and flexible scheduling. E-mail, chat rooms and bulletin boards allow students to communicate ideas with a wider variety of contacts than in the traditional classroom setting. Teachers in the Apple Classrooms of Tomorrow project are one group who have reported that computers in the classroom change the teacher's learning style to allow students more autonomy in their learning (David, 1992). The

study found that teachers tend to shift their style of teaching from a didactic (direct teacher to student instruction) to a more project based approach when computers are regularly implemented.

The third advantage the world wide web offers is that it enables new kinds of learning. Students emerging from school systems today are expected to have gained different skills than students a generation ago. Knowledge and skills of a nation's workers are imperative to its competitive success, rather than in the past when natural resources and geographic location were the important factors (Owston, 1997). Students are now expected to have skills in critical thinking, problem solving, written communication and the ability to work collaboratively according to Uchida (as cited in Owston, 1997). The web can facilitate these skills if educators promote the web with the goal of having students weigh evidence, judge the authenticity of data, compare different viewpoints on issues, research and analyze diverse sources of information, and construct their own understanding of the topic they are studying. This can be done with traditional media, yet Owston feels that the web can offer information which is instant, up-to-date, world-wide in scope and presented in a more motivating format for students to explore.

Technology Standards

The National Society for Technology in Education (ISTE,2000) sites six performance indicators as profiles for technology literate students grades 3-5, suggesting that educators use these standards and profiles as guidelines for planning technology-based activities.

1. Basic operations and concepts
2. Social, ethical, and human issues

3. Technology productivity tools

4. Technology communications tools

5. Technology research tools

6. Technology problem-solving and decision making tools

According to the Society for Technology in Education, these categories provide a framework for linking performance indicators to the national education standards. In addition, these standards and profiles can be used as guidelines for planning technology-based activities in which students succeed in learning, communication, and life skills. Students should be able to use technology to locate, evaluate and collect information from a variety of sources, use tools to process data and report results, evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks. Technology as a productivity tool should be used to enhance learning, increase productivity and promote creativity. Students should be able to use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works. Using technology as a communication tool, students need to be able to use a variety of media formats to collaborate, publish, and interact with peers and other audiences.

Based on data collected from Technology Counts 99' (1999), which surveyed K-12 teachers in California, grades K-5 teachers are more likely to use software than web sites for instruction, while teachers in grades 6-12 are more likely to use web sites than software. Fourteen percent of teachers who use the web for instruction say they do so because it helps students master necessary knowledge and skills. Fourteen percent use the web because it provides a break from normal classroom activities. Forty seven percent use it

because it gives students a valuable research/reference tool; and 34 percent use the Internet because it is motivating and interesting for students. Clearly the use of technology varies among schools, grade levels and teachers.

Constructivist Theory

The basic premise of the constructivist theory is that the learner learns best when he or she is actively involved/engaged in their own learning. Constructivism is the way in which a student learns by acting on an object within his/her environment. This acting begins the process of gaining understanding and meaning from those objects and events (Sullivan, n.d.). John Dewey (as cited in Sullivan, n.d.), believed that education depended on action and that ideas only emerged from personally meaningful experiences.

The social setting of the classroom can be a perfect stage for the constructivist approach. Working with peers, students can manipulate, explore and discuss objects in an effort to form a community of learners. Within this established community, experiences have personal meaning and importance, leading to in depth learning.

Piaget's concept of constructivism is embedded in his view of the psychological development of the child. He felt that teachers needed to understand the steps of psychological development and facilitate the student's journey through the following considerations:

- The teacher needs to provide an environment in which the students can experience spontaneous research. The classroom should be filled the authentic opportunities to challenge the students. Students should be given freedom to understand and construct meaning at their own pace through personal experiences as they develop individually

through the stages

- Learning is an active process involving trial, error, and problem solving. These are necessary for assimilation and accommodation to achieve equilibrium.
- Learning is a social process that should take place in collaborative groups with peer interaction (Sullivan, n.d.).

Role of Technology in Constructivist Teaching

The Internet has opened the door to an enormous amount of information. Today's students must learn how to manage this information, sort through it for relevance, decipher what may not be valid, and comprehend the information rather than just recite it from memory. According to Compoy's study (as cited in Matusevich, 1995), in a technology-rich environment, educators must remember that the educational focus is on learning and instructional goals, instead of on the technology itself. Technology is just a tool or vehicle for delivering instruction. Teachers need to regulate how rather than what equipment is used to make technology relevant in a constructivist environment. The constructivist theory plays an important role in computer based research. Researching a topic of interest, students have nearly unlimited access to information and resources related to the topic. In addition, students have immediate access to related topics generated by further inquiry. The web-like structure of information, hence the name world wide web, may prompt interest in a wider spectrum of topics stemming from the original interest.

Alan November (1989) describes an emerging classroom model, redefining the roles of students and teachers in a technology-rich educational

setting. Key elements to this model include:

- Students have a sense of owning and defining the problem(s) rather than the teacher.
- Assignments are designed to make a contribution to the community.
- Constant opportunities for teamwork exist.
- Students work on aspects of problems no one else has studied.
- Success can be measured by the student and other adults besides the teacher.
- Reliance on memory for testing is minimized.
- Teachers become facilitators for students who are learning skills.
- Many different skill levels are valued in the class at the same time.

In this model the roles of student and teacher evolve as teachers become facilitators of information. Students learn to apply knowledge and develop lifelong skills of teamwork, initiative, and communication. Technology can make a critical contribution of time and access.

Learning Cycle

The Learning Cycle Model of education moves students through a process of investigation by allowing them to explore materials, construct a concept, and apply this newly constructed concept to new ideas. Robert Karplus, director of the Science Curriculum Improvement Study (SCIS) of the 1960's, hypothesized that the teaching of science requires more than content and rote memorization (Marek & Cavallo, 1997). Teaching requires a plan derived from both the discipline of science and the manner in which students learn. Any research based project can implement a Learning Cycle Model. Karplus, with a team of scientists and educators, wanted to develop a program

for elementary school science. The resulting program was designed to be consistent with the investigative steps used by scientists throughout history to formulate new inventions and theories. In 1967 Karplus identified and titled three important phases: "preliminary exploration," "invention," and "discovery," later renamed as "exploration," "generalization," and "concept application." This teaching procedure is the Learning Cycle Model.

The Science Curriculum Improvement Study program established in the 1960's used the Learning Cycle as its foundation for classroom testing. Research that has evaluated the program found that students of teachers using the Learning Cycle have greater success and achievement in science and are more motivated to learn science than students being taught with other instructional procedures. These students are found to be superior in motivational and cognitive behavior according to the study by Kyle and Bonnstetter (as cited in Marek & Cavallo, 1997).

The Learning Cycle allows for a variety of teaching methods such as questioning strategies, demonstrations, and group work (Marek & Cavallo, 1997). Questions can be used for guiding discussion, determining comprehension, and eliciting further exploration. Demonstrations can be used to introduce a technique without giving away the concept to be learned, as an exploration of the upcoming concept, or as a concept application. Demonstrations can provide students with skills necessary to construct their own knowledge. Group work allows for cooperative learning. This procedure for teaching can be applied across the educational curriculum. The student is placed at the center of the learning experience, with the teacher promoting and encouraging the learning process. With the teacher's guidance, students engage in explorations, bring ideas to fruition, form new

understandings, and relate these understandings to other concepts across the curriculum and in everyday events. The students' experiences allow them to use and develop thinking processes, and form personally meaningful understandings of the world.

For the purpose of this study, the Learning Cycle will be defined as consisting of three basic stages:

1. *Exploration*: Students gather data and explore resources; this phase is student centered. The teacher provides directions and materials, answers/asks questions, gives assistance and keeps the exploration going.
2. *Generalization/Clarification*: Concepts are formed through exploration and students construct ideas from their experiences.
3. *Application*: Students organize the concepts learned with other ideas that relate to it. Students implement what they have learned and seek related information to expand the concept to begin the cycle again (Marek & Cavallo, 1997).

In computer assisted education, specifically Internet based research, students go through the Learning Cycle to construct understanding of a given topic. During the exploration stage, students seek information using prior knowledge to guide their research. When substantial information is gathered, students may begin to generalize and see patterns in what they are learning. This may lead to clarification of ideas through additional research of the topic. In the final stage students may apply their knowledge in a variety of ways, including additional research of related topics sparked by the original inquiry. The Learning Cycle Model of education provides a framework for studying the strategies students use while constructing their

own knowledge.

Learning Styles & Intelligences

Individual students learn in different ways. A differentiated curriculum will accommodate the different styles of learning. Howard Gardner (1997) cites eight human intelligences uncovered in years of research.

1. *Linguistic intelligence* is the ability to think in words and to express meanings with verbal acuity.
2. *Logical-mathematical* intelligence is the ability to quantify and carry out mathematical operations.
3. *Spatial intelligence* is the ability to think in three-dimensional terms, to navigate oneself and objects through space and to decode graphic information.
4. *Musical intelligence* is the sensitivity to pitch, rhythm, melody, and tone.
5. *Bodily-kinesthetic intelligence* is the ability to manipulate objects and fine-tune physical skills.
6. *Interpersonal intelligences* is the aptitude to understand and interact effectively with others.
7. *Intrapersonal intelligence* is having an accurate self perception and the ability to use this knowledge in managing one's life.
8. *Naturalistic intelligence* is the ability to observe patterns in natural and man-made systems, and understanding the dynamics of these patterns .

Gardner believes these intelligences are inherent in all people at varying degrees and these intelligences work independently or interdependently to solve problems, yield various kinds of vocations, avocations, and ideals. The

purpose of school according to Gardner should be to develop intelligences and to help students reach goals appropriate to their particular spectrum of intelligences. He calls the computer the "biggest influence on cognitive development today" (Gardner, 1993, p. 9), not only because of it's utility in running experiments and analyzing data, but also because of the model it provides of how children learn and think.

Multiple intelligences refer to how information is expressed or the products of learning. Learning styles refer to the process of how students think and learn (Silver et al., 1997). Kolb's Theory of Learning Styles showed that learning styles could be seen on a continuum:

1. concrete experience: being involved in a new experience
2. reflective observation: watching others or developing ideas about own experience
3. abstract conceptualization: creating theories to explain observations
4. active experimentation: using theories to solve problems and make decisions (Blackmore, 1996).

The kinesthetic, the visual and the auditory opportunities for learning are immediately apparent in the use of computers. These are supplemented by the logical-mathematical, musical or other experiences provided in the actual computer-based task in which students may be involved. Young people have been bombarded with the auditory and visual stimuli of mass communications media from an early age, and have come to expect these stimuli in their classroom experiences (Langford & Cleary, 1995). Learning styles and intelligences attempt to interpret human differences and to design educational models and tools to accommodate these differences to insure academic success.

Computer Based Assessment

Standards for assessing computer based learning have not been clearly established. Russell and Haney (1997) cite the introduction of computers and the use of authentic assessments to be the most prominent movements in education over the last two decades. Authentic assessments attempt to evaluate the learning that emerges from a technology based classroom. Assessments should be based on the responses students generate for open ended, real-world tasks. Strommen (1992) offers two assessment techniques for computer-based education. The first is to assess learning as it occurs through video taping the problem solving sequence. Videotaped records of students' interactions as they work may reveal their grasp of course material, as well as their ability to communicate what they have learned. The second form of assessment found promising is the evaluation of portfolios showing the evolution of a student's work as it is created. Such records document student progress and allow the educator to pinpoint areas of need. Twelve assessment points were made in a study done by Jonassen (as cited in Matusevich 1995):

1. Technology can and will force the issue of constructivism.
2. Assessment will have to be outcome based and student centered.
3. Assessment techniques must be developed that reflect instructional outcomes.
4. Grades must be given where grades are required.
5. There must be a non-graded option and portfolio assessment.
6. Self and peer evaluation as well as teacher assessment.
7. Develop performance standards.
8. Grading system providing meaningful feedback.

9. Technology used to communicate with parents.
10. Student video tape as part of portfolio.
11. Evaluate how learner constructs knowledge rather than the product.
12. Assessment is context dependent.

These assessment points elaborate Strommen's assessment techniques to form a more comprehensive list of criteria for authentic assessment.

CHAPTER III

METHODOLOGY

Introduction

In order to examine the research strategies students use during the phases of a Learning Cycle model of education, participants were observed and monitored while conducting Internet based research. The review of literature suggested that use of technology in a constructivist learning environment will assist students in constructing their own knowledge. This exploratory study attempted to provide insight to how and when Internet-based research is best implemented in the process of learning.

This qualitative case study focused on the activities of a select number of target students during an Internet-based classroom research project. Data were collected through informal interviews, questionnaires, observations, and work samples. Data analysis consisted of interpretation of themes and/or patterns throughout the students' research project. Results are communicated through analytical and reflective narrative, referring to the research questions posed and the literature review findings.

Research Questions

The overarching question in this study was to determine when the Internet is best used as a research tool during the Learning Cycle. The following questions were addressed:

1. Is there is a pattern of research strategies used by students at the different stages of a Learning Cycle?
2. What prompts students to choose some pathways over others?

3. Will students be more successful acquiring relevant information from the Internet if given prior knowledge of the topic?
4. Are Internet navigational skills a factor in the quantity and depth of information gathered?
5. Is the key to a successful student-research experience connected to how and when the Internet is used during the particular phases?

Several sub-questions were posed during the course of this qualitative analysis of student Internet use:

- Where and why do they became "stuck" in various web sites ?
- How far do they choose to search beyond their initial starting point?
- What kinds of information do they feel is relevant and why?
- How in-depth is the information reported in the end product, the research report?

Data collected from observation and student work were used to analyze and interpret results. Students' activity and attitudes were observed and documented during Internet searches. Navigational choices were tracked to determine if patterns existed during each Learning Cycle phase. Student work was used to assess concept understanding and extent of students research. Educational theories such as Multiple Intelligences, the Learning Cycle Model of education and constructivism were referenced for interpretation of data.

Background

Students attending the school in which the study was carried out receive computer instruction starting in Kindergarten. Each classroom houses two or more Macintosh computers for teacher and student use, and

the class has weekly access to a computer lab accommodating up to thirty students. In addition to teacher-facilitated instruction, students receive forty five minutes of instruction weekly in the lab setting from a technology specialist employed by the school district. All students involved in this study had similar school exposure to computer use. Home computer use among subjects varied and may have affected the results of this study.

The students participating in the study were in the 3rd grade, and as part of the regular third grade classroom curriculum, they engaged in researching topics and producing research papers complete with references. Students had access to three classroom computers and a school computer lab for conducting Internet searches. Prior to beginning their Arctic Animal reports, all students in this study received computer training in the areas of keyboarding and Internet navigation. In addition, students learned to use multimedia authoring software such as Hyperstudio, Easy Book, and Kid Pix. Students used a classroom web page regularly for schedule updates, guided assignments and posting their work.

Setting

Research for this study was conducted in a third grade class at a public elementary school in California in a small, affluent community in Santa Clara County. Computer technology is the major industry in the area. The school currently has 550 students in grades K-5. The student population consists of approximately 60% Caucasian, 35% Asian and 5% other. The elementary school includes grades Kindergarten through fifth, and class size for grades K-3 is 18-20 students.

Subjects

Four students, ages 8-9, participated in the study. The students were selected based on the following criteria: (a) they were students in the author's classroom and (b) the parents of the participating students returned the participation consent form. Selection based on these criteria provided a diverse sample group, opportunistically selected based on parental consent.

Participant One

Participant One was a nine year old boy. He was an extremely active student, unable to keep still in his chair. He always had an object in his hands such as scissors, crayons or erasers, which he would manipulate until it was unusable or he was told to put it away. While appearing to be involved with other activities during lectures, he would in fact listen intently and was able to respond to questions appropriately. Academically, he was an average student who struggled with writing. On the Stanford Achievement Test he scored a National Normal Curve Equivalent of 74% in Total Reading, 50% in Language Skills, and 72% in Total Math. While able to explain verbally concepts and share ideas in the areas of math and language arts, he was unable to transfer this knowledge into writing. His writing was illegible. He preferred to draw pictures and/or discuss concepts verbally to express his ideas. Socially he was well liked by classmates, although many students complained of him being very messy because his desk was consistently cluttered. Participant One's computer skills were advanced compared to his classmates. He used a home computer to produce written assignments. He had Internet access at home and used his computer for a variety of activities.

Participant Two

Participant Two was a nine year old girl. She was an extremely active student, unable to keep still in her chair. She often spoke out during classroom lectures and was very vocal with her ideas. She listened intently during class and participated in classroom discussions. She expressed ideas clearly, yet, often went off the topic bringing prior, unrelated knowledge to the discussion. Academically she was an above average student. On the Stanford Achievement Test she scored a National Normal Curve Equivalent of 86% in Total Reading, 99% in Language Skills, and 84% in Total Math. She was able to verbally explain concepts, share ideas in the areas of math and language arts, and transfer her knowledge into writing. She enjoyed drawing pictures, writing and/or discussing concepts verbally to express her ideas. Socially she was well liked by most classmates. She was very competitive with classmates and with herself. She often became frustrated when she did not immediately understand a concept. Class and homework products were often above and beyond the assignment expectation. Participant Two's computer skills were average compared to her classmates. She did not have Internet access at home and did not use the Internet outside of school.

Participant Three

Participant Three was a nine year old girl. She was a quiet student, focused on completing her work correctly. She listened intently during class and participated in classroom discussions. She expressed her ideas clearly and thoroughly. Academically she was an above average student. On the Stanford Achievement Test she scored a National Normal Curve Equivalent of 93% in Total Reading, 86% in Language Skills, and 84% in Total Math. She

was able to verbally explain concepts and share ideas in the areas of math and language arts. She could easily transfer her knowledge into her writing. She enjoyed drawing pictures, writing and/or discussing concepts verbally to express her ideas. Socially she was well liked by classmates. She did not independently perform class work above and beyond assignment expectation. She preferred to complete only the assigned tasks and showed no interest in extending her studies unless specifically told to do so. Participant Three's computer skills were average compared to her classmates. She had Internet access at home and used the Internet outside of school.

Participant Four

Participant Four was a nine year old boy. He was an extremely active student, unable to keep still in his chair. While he spoke in front of the class, he would rock back and forth, keeping in constant motion. He was talkative and liked to be the center of attention during classroom discussions by making jokes or commenting incessantly. He participated in classroom discussions if they interested him personally and he was able to express his ideas thoroughly and clearly. Academically he was an above average student. On the Stanford Achievement Test he scored a National Normal Curve Equivalent of 84% in Total Reading, 93% in Language Skills, and 93% in Total Math. He was able to express his knowledge verbally and in writing. He preferred to be the first student finished on all assignment so was not always neat and thorough. He often needed to do assignments over due to incomplete work or illegible handwriting. Socially he was well liked by classmates, although many students complained that he was overly physical. He sought attention through poking, pushing and/or grabbing other

classmates. Participant Four's computer skills were advanced compared to his classmates. He had Internet access at home and used the computer for a variety of activities.

Data Collection Instruments

The following instruments were used to gather information about students' background computer use and activity during the study:

Computer-Use Questionnaire

The student computer-use questionnaire (Appendix B) was designed to gather information regarding students' use of computers outside of school. Data were collected in the following areas: accessibility of a home computer, uses of the home computer, frequency and duration of computer use, and student attitudes towards using computers.

Data Collection Logs

The data collection logs (Appendix C) were used to track the students' Internet-based research activities during the three Learning Cycle phases of exploration, generalization/clarification, and application. The collection log included the participants' number, date and time of activity, location of the computer being used, the Learning Cycle phase of the observed activity, and the researcher's notes.

Navigator Cache

Each participant's computer cache was reviewed to determine which web sites were visited during the research process. The cache provided a list

of sites, the order they were visited, and the time they were visited. This provided information concerning quantity, relevancy and duration of student Internet research.

Student Work Samples

Student work samples (Appendix E) were monitored and collected to assess the depth of research. Students collected and recorded data on an Arctic Animal Report chart (Appendix D) and used this chart of information to write their final reports. This method of organizing information assisted students in categorizing data from multiple sources. The final reports reflected the depth of student-research and the extent to which students conducted further research.

Procedures

Permission to conduct the study was obtained in November of 1999. In order to determine the students who would participate in the study, research consent forms were sent home to the parents of 18 students in a third grade classroom. In addition, permission was secured for each student to access the Internet and to publish documents on the World Wide Web. Copies of all consent forms are available in Appendix A. Six consent forms were returned within a week's time and these students were selected to participate. Results of four of the six participants were used for in-depth analysis of study results. Results from two were not included because of incomplete records.

Computer use outside the classroom was determined by a survey (Appendix B) given to all students. This was designed to provide information regarding the computer exposure students had beyond the

computer technology skills taught in class. Students conveyed their attitudes towards computer use and shared the specific computer activities they conducted outside of class. The academic ability of each student was determined according to standardized test scores and teacher-based assessment of developmental skills within third grade educational standards.

The research took place over a period of six weeks and involved data gathered for approximately sixty minutes per day. Internet-based research activities monitored during the study were performed by all 18 students in the classroom as part of the regular third grade curriculum. The subjects in this study became unaware of their participation since their requirements were the same as their classmates. To launch the study, students were informed that they would be studying the Arctic. They were given the Arctic as a research topic and asked to conduct individual Internet searches to discover information they found to be relevant. A Learning Cycle Model, which includes exploration, generalization/clarification, and application of knowledge was used to introduce and monitor student activity. Students were allowed sixty minutes of computer lab time to research the Arctic and its inhabitants without prior knowledge of the subject. Students used a classroom web page linked to various Arctic information sites as a starting point for exploration. Students were asked to explore without guidelines. This activity was open ended as students used their own prior knowledge of Internet search strategies to begin their research. Student activity was monitored using a Learning Cycle observation log (Appendix C) to record navigational strategies throughout the phases. During the research process, participants were asked why they went to certain sites and what they found to be important information.

After the initial free-exploration phase of the research project, students engaged in exploratory activities designed to build background knowledge. Day two of the project, students read the story *The Arctic and What Lives There?* The students discussed in small groups the characteristics of the Arctic region and its inhabitants, watched a video comparing the Arctic and the Antarctic, and chose an Arctic animal to study in depth according to personal interest. The Arctic Animal Report is a GATE (Gifted and Talented Education) lesson developed by the school district's GATE Lead Teacher. The lesson was designed to meet the needs of diverse learning styles and responds to the theory of Multiple Intelligences. A copy of the lesson plan is provided in Appendix D.

Students returned to the computer lab on the third day to continue their exploration phase of the Learning Cycle and to begin the process of clarification/generalization. They gathered information via the Internet on their animal and the Arctic. Students recorded the addresses of visited sites and information they felt to be important or relevant from the site. This three week phase of student-research combined the exploration and the generalization/clarification stages of the Learning Cycle as students categorized information and discovered similarities in web sites and information the web-sites provided. After students were finished with a session of web-based research, their computer's Internet cache was reviewed to determine the quantity of visited sites, the sequence in which the sites were visited, and the time spent at each site.

When students felt they had gathered sufficient information, or when they failed to find any new information, they began writing their research reports. The reports were to contain one paragraph on each of the following

topics: habitat, food, predators, family life, relationship to man, physical characteristics, and other interesting facts. Students included a reference list and pictures obtained from their searches. During the course of writing their papers, students were able to access the Internet as needed for additional information, clarification of ideas and further exploration. The participants worked independently and/or with a partner throughout the study. The end product was a research paper containing referenced information, pictures related to the topic, and student suggestions for further study.

Upon completion of their research reports, students had the option to conduct further research into areas of interest inspired by their report. They shared their end products with their classmates and became resident experts on the Arctic animal they studied. The end product, the research paper, was analyzed for research results and depth of information gathered.

Data Analysis

Data were collected and analyzed from the student questionnaires, observations and work samples. Results of the Computer use questionnaire (Table 1) were examined and outlined for a general overview of the participants' computer experience prior to the study.

Observations focused on the process of research through the Learning Cycle Model of knowledge acquisition. Comparative analysis was used throughout data collection and results were coded according to the research questions to reveal analogous findings (Table 2). Sites visited as revealed in the navigational cache, student-recorded information, and behaviors during the research process were analyzed. Participants perceptions and strategies were linked to general social science theories.

Work samples, including participants' data collection sheets and final research reports, were reviewed for content, focusing on the quality and depth of information.

CHAPTER IV

RESULTS

This study focusing on the research strategies used by third grade students during the three phases of the Learning Cycle Model, exploration, generalization/clarification, and knowledge application, yielded evidence of patterns in Internet use. Specifically the results (Table 2) focused on students' Internet navigational skills, attitudes toward computer use, and web site pathway choices during the Learning Cycle phases. End-products of the student-based research were analyzed for content and depth.

Results

Participant One

Questionnaire results (Table 1) showed Participant One to be a regular computer user outside of school, using the computer every day for over two hours each use. He used his home computer for Internet searches, e-mail, games and graphic design. He also used a word processor, as evident in his homework, although he did not claim to use the computer for homework on the questionnaire.

During the initial phase of the Learning Cycle, exploration, Participant One was anxious to begin research, and stated verbally what he was going to do once he arrived in the lab. Students were instructed to conduct Internet-based exploration of the Arctic region to personally build general background knowledge. Students were given optional access to a classroom web site containing a list of links related to the Arctic region. Participant One chose to access the classroom site and selected two links to review for content. He

then typed in a search engine address to look for additional information. He claimed he could find more information by using a search engine and keywords. He was an experienced Internet user and was able to access reference sites using search engines such as Yahoo, Hotbot, and Ask Jeeves. He pointed to and clicked every blinking object on the screen. He sought out hyperlinks which took him to relevant, and unrelated web-sites.

After receiving additional background knowledge in class through readings, video and discussion, Participant One chose the Arctic Lemming as his inquiry topic. He again engaged in exploratory research, combining the exploration phase with the generalization/clarification phase. He immediately typed in the web address for a search engine, used the keyword lemming, and only clicked on the hits containing the word lemming. He did not read the content descriptions. After exhausting all hits from one reference list, he would type in another search engine and begin the cycle again. He spent a few minutes at each site skimming headings. He claimed to like the blinking banners and chose to click on every hyperlink to determine its destination. He visited over 25 sites and recorded information from three, stating that these sites were the only links with information related to his topic. He was fascinated with a site called Lemming Paint Ball and continued to return to this site although it was not related to the Arctic Lemming. Each new idea he discovered was eagerly shared verbally with the researcher and classmates. His Internet cache showed an extensive list of accessed sites, many unrelated to the lemming.

Participant One's final report contained several Internet photos related to the Arctic and the lemming, an extensive "other facts" paragraph which included information not contained under the other headings, and a note to

the reader telling them to choose the lemming as a research topic. Although he was often distracted by the content of the web pages he visited, he was able to extract comprehensive information, as well as supplementary data reflecting his personal interest in the topic. He continued his Internet research upon completion of his end product. He assisted classmates in finding information for their Arctic animal report.

Participant Two

Questionnaire results (Table 1) showed Participant Two to have a computer at home, but she did not have access to use it. She did use a library computer for book searches 2-3 times per week for up to 30 minutes each use.

During the initial exploration phase, Participant Two often needed assistance with navigation. Although she had the same computer instruction in school as her classmates, she was reluctant to attempt searches without specific directions and became frustrated easily if she found herself linked to an unrelated web site. She chose to use the classroom web site as a reference and accessed sites containing the word Arctic.

After receiving additional background knowledge in class through readings, video and discussion, Participant Two chose the Arctic Hare as her inquiry topic. She again engaged in exploratory research, returning to the classroom web page as a focal point. She chose the Arctic Hare site and carefully read the content description. Participant Two spent a great deal of time at each visited site. Once she arrived at a site representing her animal, she needed to be reminded how to scroll the page down to read text not visible on the screen, reflecting her lack of home computer use. She spent a great amount of time at each site reading the information, even if it was

unrelated to her topic. Upon realizing the information was unrelated, she needed assistance in navigating back to the initial list page. She stayed within the boundaries of the class web page of Arctic sites, toggling back after each site visit. She did not use hyperlinks within visited sites to go beyond the initial link during the exploration phase. After receiving some background knowledge in class and choosing the Arctic Hare as her report topic, Participant Two again engaged in research.

During the generalization/clarification phase, she became increasingly comfortable with navigational strategies. She asked a classmate for the web address of a search engine so she could expand her inquiry. She asked for help in determining where to type in the keywords. She complained of seeing too many blinking boxes and felt some of the pages were confusing. She clicked on an advertisement box at the top of the page and was taken to an irrelevant site. She became flustered and needed to be reminded how to get back. She read each list of sites carefully to determine which one would have the information she needed. Upon choosing a site, she would carefully read and record information. After accessing over ten sites during the three week investigation period, she discovered that much of the information was similar and she lost interest in browsing the Internet. Her Internet cache showed links accessed from the class web page and one outside link accessed from a search engine.

Participant Two's research report contained five Internet references. She printed out the sites so she could highlight information prior to writing. In addition to taking notes on her data collection log, she used the web page printouts to expand her writing. Her report contained facts and personal interpretation of information. Upon completion, she eagerly assisted

classmates with their research and wanted to begin research on another Arctic animal.

Participant Three

Questionnaire results (Table 1) showed Participant Three to be a regular computer user outside of school, using the computer 2-3 times per week for up to 30 minutes each use. She used her home computer for games, Internet research, e-mail, homework and creating greeting cards.

During the exploration phase of research, Participant Three worked independently to browse the various Arctic sites linked to the class web page. She did not use the hyperlinks within visited sites to go beyond the initial link during the exploration phase. After receiving some background knowledge in class and choosing the Arctic Caribou as her report topic, Participant Three again engaged in research.

During the generalization/clarification phase, Participant Three visited the caribou sites listed on the class web page and then typed in a search engine to continue her inquiry. She visited and recorded relevant information, working independently without asking for navigational assistance. She skimmed the headings on each site and referenced the hyperlinks if they contained keywords relevant to her topic. She recorded information at each site. She accesses one search engine, typed in caribou, and browsed the hit list. After reviewing several pages contained in her list, she claimed their was no information related the the caribou. She was asked if she had read the information and she said she had not. She was advised to return to the pages and read what she found. She was not interested in the pages unless they had a picture of her animal. She printed out every picture she could find. She

visited over fifteen web sites and printed information from two. She used information from these two sites in her final report. Her Internet cache showed links accessed from the class web page and several links accessed from a search engine.

Participant Three's final report contained factual information recorded in a list-like manner. She did not expand in depth on any of the topic paragraphs, and did not give any personal analysis or opinions. When she completed her research project she showed no interest in furthering her study.

Participant Four

Questionnaire results (Table 1) showed Participant Four to be a regular computer user outside of school, using the computer every day for 30 minutes to an hour each use. He used his home computer for Internet searches, e-mail, and computer games.

During the exploration phase, he browsed each Arctic site independently without assistance. He did not spend time reading for information. He did not attempt to use the hyperlinks. After visiting four of the class web page sites, he raised his hand to say he had looked at all the available information and was finished. After being asked to continue searching, he typed in a search engine to look for Arctic topics. After receiving some background knowledge in class and choosing the musk ox as his report topic, Participant Four again engaged in research.

During the generalization/clarification phase, Participant Four visited the musk ox site listed on the class web page and immediately raised his hand to claim there was no information. He was asked if he had read the

information and he said he had not. He was redirected to read the information and after doing so he recorded relevant information on his chart. He then typed in a search engine address, rather than exploring the other listed Arctic sites. Because the sites did not say musk ox, he did not feel they would contain information he needed. He used musk ox and oxen as his keywords to get lists of possible links. He visited eight web sites and did not access the hyperlinks. He used information from two of the sites claiming that the information from the other sites was redundant. He returned to the class web page and browsed all of the Arctic sites. His Internet cache showed an extensive list of accessed sites. He visited all the class web page links and several from a search engine list.

Participant Four's final report contained the facts outlined by the report requirements (Appendix D). He did not go beyond the requirements of the report to include related information and personal analysis. He finished his report quickly and needed to rewrite several sections due to redundant information. He was not interested in continuing his research and preferred to read a book upon completion of the project.

Additional research questions surfaced throughout the study. The next chapter will discuss results of the initial research questions, address the subsequent questions that arose in the course of the investigation, and provide suggestions for further inquiry.

Table 1: Computer Use Survey

	Entire Class	Subject 1	Subject 2	Subject 3	Subject 4
1. Do you have a computer at home?	18/18	Yes	Yes	Yes	Yes
2. Do you use it?	15	Yes	No	Yes	Yes
3. Do you use friends or other computer outside of school?	10	Yes	Yes	Yes	Yes
4. Activities on any computer used outside of school:					
a. e-mail	12/16	Yes	No	Yes	Yes
b. Games	14	Yes	No	Yes	Yes
c. Homework	6	No	No	No	Yes
d. Internet browsing	9	Yes	Yes	Yes	Yes
e. *Other	6	Yes	Yes	No	Yes
5. How often do you use a non-school computer?					
a. Never	2				
b. 2-4 times a week	12		X	X	
c. Every day	4	X			X
6. Duration for use of non-school computer.					
a. 0-30 Minutes	7		X	X	
b. 30-60 minutes	6				X
c. 1-2 hours	1				
d. More than 2 hours	2	X			
7. Is there anything you dislike about computers?					
Yes	8				
No	10	X	X	X	X

*Explanation of "other" activities:

Subject 1 – Designing half-pipes for skateboarding and editing movies and pictures.

Subject 2 – Searching for books on the library computer.

Subject 4– Creating cards and letters to send to friends and family.

8. What do you enjoy most about using computers?

Subject 1 – They give me the ability to access so much knowledge and information.

Subject 2 – They make getting answers to questions very easy with so much information.

Subject 3 – The wide variety of games both on CD-ROM and accessible via the Internet.

Subject 4 – The ability to play games and to interact with friends and family via email and chat.

Table 2: Summary of Results

Research Phase	Participant One	Participant Two	Participant Three	Participant Four
• exploration	-Eager to begin -Independent -Searched continuously -Did not want direction -Strayed off topic	-Apprehensive -Required assistance -Became stuck and frustrated -Wanted direction -On topic	-Apathetic -Independent -Cautious and conservative -Wanted direction -On topic	-Excited to begin -Independent -Became stuck and frustrated -Wanted direction -On topic
• generalization/ clarification	-Independent -Search engine -Did not preview links -Extensive Information -Somewhat distracted -Off and on topic	-Needed some assistance -Annoyed with visuals -Search engine -Moved cautiously through sites -Found redundant information -On topic	-Independent -Interested in visual stimuli -Search engine -Methodic -On topic	-Needed some assistance -Not interested in sites except exact keyword matches -Search engine -Rushed -On topic
• application	-Comprehensive and informative -Personal interest evident -Continued involvement even after project completion	-Detailed and thorough -Good use of relevant data -Personal interpretations -Eager to assist others	-Factual information -No personal interest in subject matter -No continued involvement	-Fulfilled report requirements -Included limited analysis -A re-write was required due to redundant information -No interest following completion
Pathway choices	-Extensive -Hyperlinks accessed -Class page an search engines -Many unrelated sites -Explored personal interest sites	-Limited -Initially bound by class web page, one search engine -No hyperlinks -Some unrelated sites -Explored personal interest sites	-Fulfilled requirements -No hyperlinks -Class page and search engines -No unrelated sites -No personal interest sites	-Fulfilled requirements -No hyperlinks -Class page and search engines -No unrelated sites -No personal interest sites
Affects of Internet navigation skills	-Independent -Higher quantity of visited sites -Unrelated searches in addition to focused searches	-Needed assistance -Lower quantity of visited sites -Focused searches -Need of background information	-Independent -Higher quantity of visited sites -Focused searches	-Independent -Higher quantity of visited sites -Focused searches
Depth of information	-Personal interest -Extended research	-Personal interest -Extended research	-Fulfilled requirements -No additional research	Fulfilled requirements -No additional research

CHAPTER V

DISCUSSION AND CONCLUSIONS

The purpose of this investigative study was to gain insight into the navigational strategies used by third grade students while conducting Internet research. The web sites they chose to access, the amount of time they spent in each visited web site, and the information they deemed important helped to determine the effectiveness of Internet use during the Learning Cycle phases of exploration, generalization/clarification, and application. The end product, the research report, indicated the overall depth of student research and the interest level of each student. The research questions are referenced during the discussion of results for indication of patterns and/or trends.

Discussion

Participant One

Participant One is an experienced Internet user. Having a home computer and having unlimited access to use it puts him at an advantage over his peers when it comes to using the Internet as a research tool. Through practice, he is comfortable navigating and does not fear getting lost in the World Wide Web. He is a very kinesthetic and visual learner, and the interactive nature of many web sites appeals to his learning style. He is enthusiastic about the research and even willing to write out his findings despite his dislike for written expression. He needs to share his findings verbally with peers, to give his research validity. This is his opportunity to use his verbal skills. During the exploration phase he jumps from web site to

web site, not to gather information but to see how much he can find, regardless of its relevancy. He has free reign to explore and he takes advantage of this opportunity. This constructivist method of research differentiates the assignment and inspires Participant One to perform tasks he normally tries to avoid. He can look at every hyperlink, listen to sound bytes, watch movies, and explore any aspects of the web sites he finds interesting. This supports Owstons' (1997) contention that students of today tend to be more visual learners and that the Internet offers a world of visual stimuli making the task of research seem more exciting to students. Participant One previews related and unrelated web-sites. He does not have a focus and is therefore determined to browse as many visually stimulating sites as possible. Once he chooses his topic of study, the focus of his searches narrows significantly.

Given background knowledge he can interpret how the different sites are arranged to offer information. He seeks out headings with key words and looks for graphics to direct him to appropriate links. He knows the general information he needs so he gathers necessary facts, then spends his time seeking additional information which interests him personally. This supports Vockell and Van Duesen's study (1989) which found that use of a computer during research tasks allows students to collect information more quickly, providing additional time for extended inquiry. He does not read text-only sites because they do not offer any visual stimuli. He knows he can find more visual sites. The layout and appearance of the web sites play an important role in his research. He spends more time in these web sites, regardless of the information they offer. His confidence and experience with computer use shows in the number of sites listed in his Internet cache. He is able to

navigate quickly and efficiently. If he finds himself in an unrelated site, he quickly backs out to try another path.

Applying his knowledge in a research report comes easy to Participant One because of the amount of information he is able to gather during the exploration, and the generalization/clarification phases of the Learning Cycle. According to this model, Participant One was at the center of the learning experience, bringing ideas to fruition, forming new understandings, and relating these understandings to other concepts of interest (Marek & Cavallo, 1997). His research process is kinesthetic and verbal, reflecting his personal style of knowledge acquisition as supported by the Learning Style Theory (Silver et al., 1997). He needs to be in constant motion, physically or while navigating the Internet. Sharing his ideas verbally validates the information he discovers. Because he has constructed his knowledge through a self directed research project, his distaste for written expression is forgotten and he eagerly focuses on assembling his report. This student, usually unwilling to focus his efforts on writing, completes this assignment efficiently, and with the desire to continue his research. This constructivist Learning Cycle approach allows Participant One to express his ideas throughout the learning process. The information he provides in his final product reflects his interest in the topic. Upon completion of the activity, he continues to seek new information and express his interest in the topic.

Participant Two

Participant Two is not as experienced as One in Internet navigation, and needs assistance during the exploration and the generalization/ clarification phases. Because she does not have access to a home computer,

she is unable to practice the Internet research skills she learns at school. She becomes frustrated as she watches her peers performing tasks she had not done before, and her competitive nature makes her reluctant to ask for peer assistance. Her desire to achieve has made her somewhat reliant on her teachers for guidance, and reluctant to try things she may not be immediately successful in doing. Free exploration of a general topic has left her feeling disjointed. She wants structure. She gains this by staying within the boundaries of the classroom web page, reading all the information in each site, and asking for teacher assistance immediately when she cannot get back to the initial web site. Participant Two's style of learning reflects a careful, analytical approach to research (Silver et al., 1997).

During the generalization/clarification phase, Participant Two is much more relaxed. She has a specific topic to explore guidelines for the kind of information she is to look for, and some background knowledge of the research topic from class discussion. The background knowledge has given her confidence and she no longer feels the need to completely read the information from every site she visits. She now searches for headings and carefully selects relevant sites based on keywords. She quickly discovers the similarities in content and her navigation skills improve. She asks a classmate to give her the address of a search engine so she can broaden her searches. The number of sites she visits increases as this phase of the Learning Cycle progresses and she constructs her own concept of understanding. This supports the Learning Cycle procedure presented by Marek and Cavallo (1997). She prefers to print out her findings so she may refer to the text for patterns in information. This reflects her logical-mathematical intelligence during the application phase (Gardner, 1997). She

does not want to rely on her handwritten notes to provide the depth of information contained in the articles she reads.

Her limited experience with computer use shows in the number of sites listed in her Internet cache. She is not able to navigate quickly and becomes flustered when a site is irrelevant. This prevents her from taking risks such as experimenting with hyperlinks. She initially stays within the boundaries of the class web page, and when she does use a search engine, she navigates between the hit list and the chosen sites, without accessing additional sites within the sites she chooses.

Her research report contains five references, more than any other student the class. Not only is she able to locate several related web sites, she is able to interpret and record a variety of information from each one of them. Her writing skills take over in the application phase of the project. Being highly skilled in reading and language, she is able to interpret data and share her findings in her own style. Regardless of initial navigational skill deficits, she produces a thorough project reflecting her style of learning. She adds personal reflection to each topic of her report.

Participant Three

Participant Three, like One, is also an experienced Internet user. Having access to a home computer for Internet searches and e-mail allows her to be more comfortable with Internet navigation than her peers who do not have computer access at home. During the initial exploration phase she scans the class web page links and accesses a search engine to type in her own key words. She does not stray far from the initial sites. Gardner (1997) would deem this student predominantly logical and mathematical in her learning

style. She takes a logical, linear approach to analyzing the web pages. If the pages do not contain headings with keywords related to her topic, she returns to the initial hit list and tries another site. She does not access hyperlinks within the pages because they are not part of the main headings. She eventually asks for assistance because she does not know what specific information she should be looking for. She wants a concrete task, and does not understand that the task itself is the process of exploration. This open-ended assignment is not something she is comfortable with, even though she is familiar with using the Internet.

During the generalization/clarification phase she systematically collects her information, going in the order on her data collection sheet. Her need to be precise hinders her ability to collect information of personal interest beyond the requirements of the assignment. She collects exactly what she needs and ignores other information. When she is asked to return to the Internet to find facts not already stated in her report, she is able to do so because it was an assigned activity. Participant Three is a very objective researcher, using her wealth of Internet navigational skills to systematically fulfill the requirements of the task. Her confidence and experience with computer use shows in the number of sites listed in her Internet cache. While she is able to navigate quickly and efficiently, she does not go beyond the task requirements to seek information of personal interest.

Her final report is written as a list of facts, just as she had collected the information. She has visited over ten related web sites, but only uses information from two of them, claiming that the others offer only redundant information. While her report is precise, it lacks personal analysis of her topic. She is not interested in continuing her research. This assignment does

not appear to spark her interest. This does not support Windschitl's (1998) contention that students will be inspired by and have a richer inquiry experience due to the wealth of visual information provided by the Internet. It was just another class assignment to complete and she is content to fulfill the minimum requirements without further inquiry.

Participant Four

Participant Four is also an experienced Internet user, having access to a home computer for a variety of computer-based activities including Internet searches. He is confident in his skills and prefers to work independently. Because he feels the need to be the first student finished, he does not take his time to explore the sites he visits. This is a problem during the exploration phase. While he is adept at Internet navigation and using search engines, his impatience limits his ability to recognize relevant information. During the initial exploration phase of the Arctic region, his skills are limited by his desire to finish quickly. He gives up easily and asks for assistance when the information he is looking for is not readily apparent. When directed back to the previous site and told to read the information, he then sees the information he was seeking. His experience with Internet use shows in the number of sites listed in his cache. He is able to navigate quickly and efficiently, but does not spend adequate time in any one site. This caused him to miss potentially relevant information.

Given a more specific topic in the generalization/clarification phase he is again off to a slow start. The first site he visits is text only and he does not read the information. The class' web page link said musk ox so he knows it should contain information he needs. Because there are no identifying

pictures or headings he asks for assistance in locating the information, without reading any text. When he is reminded that he needs to read the text to find the information, he skims each visited site quickly. He eventually finds the data he is seeking, but he does not go beyond the scope of the assignment and seek related topics of personal interest. He is interested in the web page layout. He collects only information specifically outlined on his collection chart. He is too intent on finishing the task. After completing several drafts of his report, Participant Four is able to produce an adequate report, containing some personal analysis of information. Academically he is an average to above average student. This assists him in ultimately producing an acceptable research paper, even if his interest does not lie within the process of completing the activity. He does not wish to further his research upon completion of the written report.

Conclusions

The review of literature for this study concentrated on three major areas. The first area focused on computer use and technology standards in education. The learning theories of Constructivism, The Learning Cycle, Multiple Intelligences, and Learning Styles were described in the following section. The final area of the literature review detailed computer-based assessment strategies used in education. Several advantages to using the Internet as an interactive educational tool were revealed. While gathering information from the Internet is similar to textbook-based research, the Internet offers a more dynamic interface. Web sites offer visual stimuli not available in textbooks. Some sites contain sound bytes and movies, prompting student interest. The expanse of information and the speed at

which information can be gathered increases the depth of research. Mann (as cited in Matusevich, 1995) contends that education is being partially transformed by new technologies. At one time students could learn a small, but fixed body of knowledge, depending on classroom resources. Because of today's vast amount of available information, and the fact that the amount of knowledge in the world continues to double, the educational system needs to transform its practices (Matusevich, 1995). According to Mann, the student of today must learn to be an information manager rather than an information regurgitator.

During this study, students were observed during the three phases of the Learning Cycle while they conducted Internet based research. Navigational strategies, time on task, and overall depth of information gathered during the exploration, generalization/clarification and the application of knowledge phases were analyzed for patterns. Students' attitudes and/or interest levels during each phase were an important indicator of potential research success.

There appear to be patterns of Internet use by the study participants during the phases of the Learning Cycle. During the initial exploration phase, students experienced frustration, had trouble recognizing relative information, and required more assistance with navigation, regardless of their navigational skill level. With the exception of Participant One, the students explored independently for a short time span before realizing they were not seeking anything specific. Once this was realized they wanted direction. Participant One was able to enjoy the process while his peers wanted to work towards a product. He visited the greatest number of irrelevant sites.

Having background knowledge introduced after the initial exploration phase, students were able to identify relevant keywords, type in keywords for search engines, and generate applicable lists of references to investigate. The Internet was most effectively used in the generalization/clarification phase for all the study participants. It was an affective tool during the application phase for students interested in going beyond the project requirements.

Research strategies during the generalization/clarification phase were more focused and students were more successful at finding applicable sites. They were able to work more independently, conversing with peers to share findings rather than to ask for assistance. They were able to facilitate their learning experience, with the teacher promoting and encouraging the learning process as outlined in the Learning Cycle Model presented by Marek and Cavallo (1997).

The application phase of the Learning Cycle revealed varying results based on the individual learning style of the student. Completing the assignment was the incentive for some, while the process of research and addressing personal interest was the driving force for others. After writing the research report, students interested in the research process continued their studies. Students concerned with completing the assignment and fulfilling the criteria did not continue their research.

Internet navigation experience varied among the class. Students with access to a home computer were more successful initially in conducting independent searches, but this balanced out as students moved into the generalization/clarification phase of the Learning Cycle. Students without the additional home computer access needed assistance with general navigational skills. It depended on the individual student's learning style,

rather than on their computer skills, how far they would navigate from an original web site, what kinds of information they found to be important, and what web sites drew their attention. Many of the students were drawn to hyperlinks, flashing text and other visual stimuli. Some found these features to be distracting and avoided them. During the generalization/clarification phase, students focused their research on a specific Arctic animal. Their searches became more focused and they needed less assistance. They chose sites based on keywords, pictures and visual layout.

The number of visited sites initially reflected the students' level of experience using the Internet outside of school. While students with access to a home computer showed superior navigational skills, the quantity and quality of information they gathered was similar to their peers who did not have access to a home computer. As students became more familiar with their topic, and more comfortable using the Internet, the number of visited sites increased. Students who preferred to complete the assignment as outlined visited fewer sites.

The research reports produced in the application of knowledge phase of the Learning Cycle revealed the depth of student findings and the direction students chose to take for further study. The structural quality of the report reflected the academic level of the student. The depth of research beyond the requirements of the assignment, based on student generated interest, reflected the students' learning styles and their personal interest in the research topic. Several students wanted to learn about other Arctic animals, while some felt satisfied with completing the initial task and did not wish to explore further. The constructivist aspect of this research assignment allowed students to create their own knowledge of the topic (Sullivan, n.d.).

There were several limitations inherent in the study. The research participants included students with a variety of home-based computer skills in addition to the standard school-based computer instruction, affecting the quantity of information accessed. Skill levels within the sample group varied significantly. The study was limited to four participants, observed for a duration of six weeks. Ethnic, cultural and gender differences were not addressed as factors affecting Internet research strategies. Results from this small sample group study could not be used to construct generalizations for a larger population.

Implications for Further Research

This study raised the following questions for addition research:

- How are students' learning styles a factor in a computer-based instructional environment?
- Is age and/or developmental level a factor?
- How can web page designers best address the variety of learning styles in the web page layout and content?
- What is the best method of assessing Internet-based research projects for content and depth?

These questions address the concerns educators have with successfully producing, implementing, and assessing computer based education. Students' learning styles and developmental levels may be factors affecting curriculum design if further investigative findings reveal the impact of these factors on computer based learning.

The Internet provides interactive communication combined with visual and auditory stimuli. These features appeal to the diverse learning

styles and intelligences of students (Langford & Cleary, 1995).
Educators need to develop computer -based curriculum with regards to student learning styles and intelligences. While computer use is wide spread in the educational setting, standards for implementation and assessment of computer based learning has not been clearly established. Internet based research is an open-ended activity and assessment techniques must reflect this constructivist style of inquiry (Strommen, 1992).

Students chose various web sites according to keywords contained in the hit lists and the arrangement of the keywords. The amount of time they spent in the chosen web site was greatly affected by the visual layout of the page. Background knowledge established in class through discussion, literature and video, proved valuable in providing students with direction during the exploration and the generalization/clarification phases. Without the background knowledge, students were not sure of what information to look for and were not comfortable with open ended exploration. With background knowledge and a specific Arctic animal as a focus, students conducted detailed searches. The less experienced Internet users became increasingly adept at navigating through the related sites.

Additional research on how web page design stimulates student interest at various grade levels would assist educators in planning for successful Internet based projects. There are many potential advantages to using the Internet for research. While students conduct research in the same manner as traditional text-based inquiry, the speed at which information can be gathered and the expanse of information available allows students more time to reflect on what they have discovered and to expand their search into related topics. This supports the findings by Widschitl (1998).

Results of this study can help the field become more familiar with process and benefits of Internet based research. This qualitative study is itself in the exploration phase of determining what tools to use during Internet research, when to implement the tools, and how to use them for successful student research. The level of frustration experienced by the study participants during the initial exploration phase suggests the need for improved navigational competence prior to embarking on an open ended research project. Students need to be taught how to conduct research using a variety of mediums, text or Internet-based. Knowledge of how to conduct research may affect students' computer use, pathway choices and behaviors towards the computer as an educational tool. The next phase for continued research would be to focus on a specific Internet research strategy, conduct a study using a larger sample group, and recommend the adoption of the successful strategy by other educators. It is at this point in the Learning Cycle that the generalization/clarification phase can be implemented in a systematic approach to establish rules and guidelines for ultimately recommending a theory of Internet-based research.

This study was valuable in precipitating the author's own thinking and awareness of diverse research strategies as they relate to student learning styles and learning phases. This will affect future research projects conducted by students in the author's classroom. Extended research of the findings presented in this study may result in the evolution of an Internet-based educational theory, applicable in curriculum design and implementation.

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APPENDIX A

CONSENT FORMS

Foothill School
13919 Lynde Avenue
Saratoga, California 950~0
(408) 86~-4036 Fax (408) 86~-~959

Saratoga Union School District Mary Gardner, Superintendent

November 24, 1999

To Whom It May Concern:

This is to give express permission for Stephanie Steinbeck to conduct a research study approved by San Jose State University. The study will be conducted in her classroom using students whose parents have granted permission for student participation. All student data will be kept confidential.

Sincerely,

Helen Sullivan

Helen Sullivan
Principal

San José State
UNIVERSITY

Office of the Academic
Vice President

Associate Vice President
Graduate Studies and Research

TO: Stephanie Steinbeck
22420 Salem Ave., #3
Cupertino, CA 95014

FROM: Nabil Ibrahim,
AVP, Graduate Studies & Research

DATE: December 14, 1999

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Research Strategies used by 3rd Grade Students at Different Stages of the Learning Cycle"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to any and all data that may be collected from the subjects. The Board's approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Nabil Ibrahim, Ph.D., immediately. Injury includes but is not limited to bodily harm, psychological trauma and release of potentially damaging personal information.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

San José State
UNIVERSITY

College of Education
Division of Teacher Education
One Washington Square
San Jose, CA 95192-0076
Bilingual Education
Child Development
Elementary Education
Secondary Education

Web Based Research Study

Title of Study: Web-Based Research Strategies used by Third Grade Students at Different Stages of the Learning Cycle

Dear Parents,
I am conducting a study in web-based research strategies for my Masters thesis. I will be observing and recording the techniques used by third grade students to navigate and collect information from interactive web pages. The sites used will be designed for their educational level and curriculum requirements. I wish to assure you that all activities related to the project are part of the regular classroom instruction. Your child will be observed in his/her regular educational setting. Student research strategies while using the school computer lab and classroom computers will be observed and documented.

There are no foreseeable risks to your child as a result of this study. The activities will further enhance your child's ability to effectively use the Internet as an educational tool. The results of this study may be published, but any information that could result in your child's identification will remain confidential. Your participation is voluntary and choosing not to participate in this study, or in any part of this study, will not jeopardize your student's education.

If you have questions about this study, I will be happy to talk with you. I can be reached at (408) 996-0430. Complaints about the research may be presented to my Research Study Advisor Karen Reynolds, Ph.D., at (408) 924-3749. Questions about research, subjects' rights, or research-related injury may be presented to Nabil Ibrahim, Associate Vice President for Graduate Studies and Research, at (408) 924-2480.

If you agree to have your child participate in this study please sign and return this form.

Name of Child	Parent Signature	Date
Relation to Child		**Phone #**
Investigator's Signature		

Saratoga Union School District
Permission to Publish

Dear Parents:

As part of your child's educational program, (s)he will have the opportunity to publish documents and projects on the World Wide Web. These documents might include a personal home page, a story or poem, a graphic, a science or research project, a group photograph from an activity or club, or a collaborative project with other students locally or internationally. Individuals with Internet access around the world will be able to view and possibly respond to your child's work by electronic mail via classroom teacher. We think this is an exciting and enriching opportunity for our students.

We will publish these documents only with your written permission. Please consider the following options, then sign and return this form to your child's teacher. Thank you for your cooperation.

Saratoga Union School District Guidelines:

- Published documents will not include personal information such as home address, phone numbers or last name;
- Documents will not include any information which indicates the physical location of a student at a given time other than attendance at a particular school or participation in school activities;
- Documents containing photographs will not include any names to ensure the privacy of student(s) depicted in the document;

Additionally, documents must be edited and approved by referring teacher and school principal before publication.

Parent/Student Permission:

Student Name _____

I grant _____ permission to publish documents on the World Wide Web as described above, including the following: (initial all that apply)

Initials _____ First Name - Documents Only

Initials _____ Photograph - No names as stated above

I do not grant _____ permission to publish documents as described above.

_____	_____	_____
Student Signature	Parent Signature	Date

This permission form will be in effect for the 1999-2000 school year. If at any time you wish to change this, you may contact the principal of the school your child attends to complete a new form.

SUSD Web Publishing Permission Form 9/99dh

SARATOGA UNION SCHOOL DISTRICT
20460 FORREST HILLS DRIVE
SARATOGA, CALIFORNIA 95070
(408)867-3424

Primary Telecommunications - Use Agreement

We are pleased to announce that at Foothill School electronic information services are now available to students and staff. The Saratoga Union School District strongly believes in the educational value of electronic services and recognizes their potential to support its curriculum and student learning by facilitating resource sharing, innovation and communication. The Saratoga Union School District will make every effort to protect students and teachers from any misuses or abuses as a result of their experience with an information service, but please discuss the following use guidelines with your child and sign where indicated. Your and your child's signatures will indicate acknowledgment and understanding of these standards. As a user of this service your child will be expected to abide by the generally accepted rules of network etiquette.

Telecommunications-Use Guidelines:

1. **Be Polite.** Never send, or encourage others to send messages that are not polite.

2. **Use appropriate, respectful language.** Remember that you are a representative of your school and district when you are on-line. Always use language that you know is appropriate and respectful in your messages.

3. **Privacy.** Do not send any message that includes personal information such as a home address or phone number for yourself or any other person. Report to your teacher any person who asks for personal information.

4. **Electronic mail.** Electronic mail is not guaranteed to be private. Services often monitor E-mail to insure that it is appropriate and accounts can be canceled if guidelines are not followed.

5. **Information.** The information accessed by the use of electronic services may or may not be accurate. The Saratoga Union School District makes no guarantees of any kind concerning the accuracy of information obtained on-line.

6. **Vandalism.** Never move, delete, or trash any applications or files that are not yours.

Required Signatures

I understand and will follow the guidelines listed in this document. I understand that the use of this electronic service is a privilege, and inappropriate use will result in the loss of that privilege.

_____ _____

User Signature Parent or Guardian Signature

_____

Date

10/98

APPENDIX B

COMPUTER USE QUESTIONNAIRE

Name_____#_____ Date_____

Computer Use Survey

Circle your answers

1. Do you have a computer at home? Yes No

2. Do you use the computer at home? Yes No

3. Do you use a friend's computer or a library computer not at school?

Yes No

4. Fill in the bubble next to the activities you do on your home computer, or any other computer you use outside of school.

O Homework
O Computer Games
O Internet searches
O E-mail
O Other

*** Please explain any other computer activities.**_____

_____

_____

Circle your answers

5. How often do you use a computer outside of school?

Never 2-4 times a week every day

6. About how long do you stay on the computer each time you use it?

5-30minutes 30min.-1hour 1-2hours over 2 hours

7. What do you like most about using computers? Why?

8. Is there anything you do not like about using computers? Why?

APPENDIX C

STUDENT OBSERVATION LOGS

Data Collection

Subject #_____ Date/Time _____

Activity_____Location _____

Learning Cycle Phase: Exploration Generalization/clarification Application

Observations_____

APPENDIX D

SAMPLE LESSON PLANS

GATE LESSON # SSD

GRADE 3

TITLE: ARCTIC ANIMALS REPORT WRITING

CREDIT: SARATOGA UNION SCHOOL DISTRICT 3RD GRADE TEACHERS

Title: "ARCTIC ANIMALS AND WHO LIVES THERE' IMPRESSIONS "OVER THE MOUNTAIN" pages 212-222.

Gate Objectives: Students will learn to write a report.
Students will experience use of different types of materials, researching skills and note taking.
Students will have the opportunity to participate in cooperative brainstorming using fluent thinking with a partner.

Language Arts Objectives:
Students will learn to:
Write a report
Rewriting factual information (note taking)
Read for information
Brainstorm with a partner (choice)
Learn to use different materials and sources
Evaluation of self and partner, teacher

Social Studies Objectives:
Students will study
1. The Arctic
2. Animal Habitats
3. ecology

Set Up:
Whole group-discuss animals
Then pairs for brainstorming-report information
Pair grouping-research report
Whole group-share report

Procedure:

Have the class read pages 212-222.
Do WKBK page 106-107 Arctic Dictionary of Terms
Have them choose an animal
Have them brainstorm what they know about the animal
Read for information about their animal and take notes
Choose who is doing what for the report
Work time in class
Present the report to the class, orally and with the use of visual aids (their report)
Evaluations

EXTENSION ACTIVITIES:

Polar Animal Songs (see attached)
Arctic/Antarctic Compare and contrast worksheets (attached)
Read books:
"A Tale of Antarctica," Ulco Glimmerveen
"Here is the Arctic Winter" Madeleine Dunphy
Clay models of Arctic animals
Water color silhouettes

ANIMAL REPORTS

APPEARANCE

What does the animal look like?

How big is the animal. Length, height, weight?

Does the animal's fur or feathers change colors?

HABITAT

Where does the animal live?

Does it live with a herd or is it solitary?

Does it live in the Arctic all year?

Does it live in the same place all year?

Does it migrate?

FAMILY

How many babies does it have?

Do both the father and mother raise the young or just one?

How do they care for their young?

Does it Make a home to raise its young?

FOOD

What plants or animals does the animal eat?

How does the animal find its food in all seasons?

What animals eat your animal?

RELATIONSHIP TO MAN

WHAT IS THE RELATIONSHIP IF ANY?

-used for food, clothing, warmth?

-hunted or do they hunt man?

-researched/protected?

What other facts did you learn about your animal. Tell any other interesting fact you learned about your animal that do not fit under the other headings.

Tell what you learned about your animal that you did not know before. Tell what you would still like to know that you were not able to find out.

At the end of your report list the titles and authors of the books in which you found your information

Do any work sheets and include them with your report.

See Attached for Bibliography

Report:

THINGS TO DO:

1 Choose a topic
2 Design a cover for the report (it must show topic)
3 Title page
4 Body of the Report
   a. where it is found
   b, what it eats
   c. what it looks like
   d. type of home
   e. relationship to man
   f. other facts
5. Include with the report
   a. 2 original drawings
   b. 1 map or graph or picture
6. Vocabulary write and define in your writing what is:
   1. Tundra
   2. Diatom
   3. Krill
   4. Plankton
7. Bibliography

*Any extra information you collected

REPORT EVALUATION

`NAME: _____ NUMBER: _____

REPORT ON: _____

PARTNER: _____

1. How would you rate the effort you put into the report? What contributions did you make? RATING (1-10. 10 being excellent) _____

2. How would you rate the effort of you partner? What were their contributions? RATING _____

3. What about your report makes you proud? What is your favorite part?

4. What did you learn in writing your report?

5. Comments:

ARCTIC REPORT

GRADING SHEET

Names: _____

_____

1.	Required areas of research	(50/50)	_____
2.	Definitions (3)	(15/15)	_____
3.	Illustrations (2)	(10/10)	_____
4.	Bibliography	(10/10)	_____
5.	Neatness	(5/5)	_____
6.	Turned in on time	(5/5)	_____
7.	Effort	(5/5)	_____

COMMENTS: _____ TOTAL _____

_____

_____

_____

_____

_____

STUDENT GRADING:

From this report, we learned... _____

_____

_____

The best part of our report is... _____

_____

_____

We think we could have done better on... _____

_____

_____

ARCTIC ANIMAL REPORT

NAME: ANIMAL:	APPEARANCE Describe the animal's looks including color, size, length, height , weight, and it's protective covering.	HABITAT Tell where the animal lives including whether or not it lives by itself or with others.	FAMILY Describe how babies are raised and cared for.
SOURCE:			
SOURCE:			
SOURCE:			

	FOOD What does your animal eat? What eats your animal?	RELATIONSHIP TO MAN Is there a relathionship to Man? Is the animal used for food,clothing, or is it protected?	OTHER FACTS What other interesting facts did you learn about your animal?
SOURCE:			
SOURCE:			
SOURCE:			

APPENDIX E

STUDENT WORK SAMPLES

ARCTIC ANIMAL REPORT

NAME: [redacted]

ANIMAL: [illegible]

	APPEARANCE Describe the animal's looks including color, size, length, height, weight, and it's protective covering.	HABITAT Tell where the animal lives including whether or not it lives by itself or with others.	FAMILY Describe how babies are raised and cared for.
SOURCE: Simple [illegible] Barron [illegible]	[illegible] hearing [illegible]	[illegible]	Pack:
SOURCE: Arctic Babies Kathy Darling Scholastic Inc. 1996 www.Scholastic/Arctic.html	-Babies weight 2 pounds and length is 2 feet -They weight 70 pounds at 10 days -For a few hours the pups furry coat is stained with birth fluids. -Pups are furry white. -Adult seals weight is 400 pounds and length is 6 feet.	-Birth place is on tumbled sea ice. --They live in Arctic seas and nearby areas of the North Atlantic.	-Mother cares for baby up to 2 weeks
SOURCE: [illegible]	[illegible]		

	FOOD What does your animal eat? What eats your animal?	**RELATIONSHIP TO MAN** Is there a relathionship to Man? Is the animal used for food,clothing, or is it protected?	**OTHER FACTS** What other interesting facts did you learn about your animal?
SOURCE:	harps		follow pray long dista
SOURCE:	-Babies drink only milk for 10 to 14 days. -Babies eat shrimp, krill, and small fish aft 11 days Enemies are polar bears, killer whales, humans, and ice.		-Harp Seal mothers abandon their baby after 10 days. -Baby name: Calf or Pup. -Males and females are about same. -Have no littermates
SOURCE:	polar bears eat them.		-live up to 30 yea

ARCTIC ANIMAL REPORT

NAME: [redacted]

ANIMAL: Caribou / reindeer

	APPEARANCE Describe the animal's looks including color, size, length, height, weight, and it's protective covering.	HABITAT Tell where the animal lives including whether or not it lives by itself or with others.	FAMILY Describe how babies are raised and cared for.
SOURCE: http://www.mnh.si.edu/arctic/html/caribou_reindeer.html Caribou & Reindeer ©1997 Smithsonian Institution	large, with, elk-like animals X	above the tree-line	X
SOURCE: Planet [illegible]-com [illegible]	Brown, white, large, 127 cm. 1.8 to 2.0 tall in 20 cm. Antlers 117 cm 47 pts. X	-woodlands / forest -arctic tundra -Northern Europe / Asia / (live in Canada) Greenland / Russia & Alaska	gestation 210-240 13 years in wild, over 20 years in capti.
SOURCE: The Caribou [illegible] Arctic North http://www.[illegible]	-long, thick coat, large -Males 72 to 78 inches [illegible] to 72 165, -reindeer smaller X	- Northern North America, Canada, Greenland, Alaska and Arctic islands to Arctic Circle.	X

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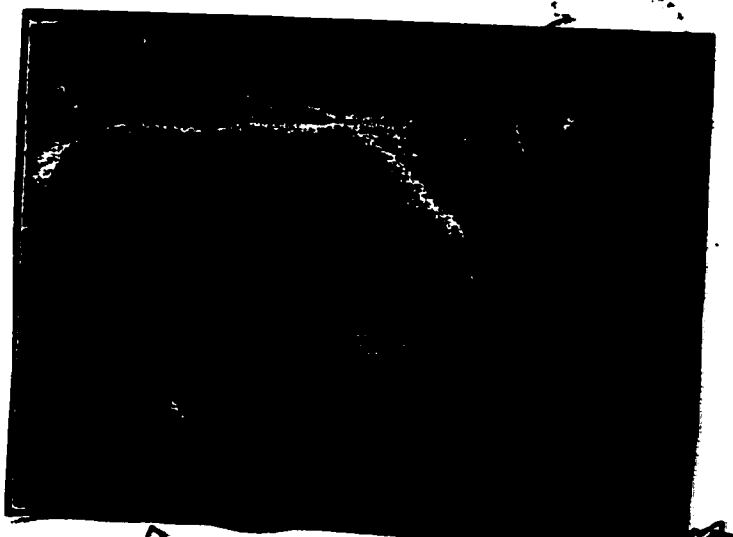
	FOOD What does your animal eat? What eats your animal?	**RELATIONSHIP TO MAN** Is there a relathionship to Man? Is the animal used for food,clothing, or is it protected?	**OTHER FACTS** What other interesting facts did you learn about your animal?
SOURCE: [illegible]			
SOURCE: [illegible]	- vegetation - lichens - grasses, plants - wolf	- ~~wolf~~ enemy - ~~sport hunting~~ ~~- habitat destruction~~ - ~~[illegible]~~	- life span → 13 – 20 yrs. - ~~In winter goes to Antarctica~~ - ~~In summer goes back~~
SOURCE: [illegible]	- wolf - grizzly bears - lynxes - wolverines - coyotes - foxes - birds - eagle	- ~~main~~ enemy - ~~hunted for centuries~~ - ~~flesh provides food, hide for clothing and blankets~~ - The fur itself can be woven - spun together for tents and clothing by [illegible]	~~It may... snorts, bellows, grunts, barks, snorts, sneezes and coughs~~

The Caribou

By: [redacted]

Publish ea by: Room [redacted]

Reindeer (Caribou) *Rangifer tarandus*



The Arctic

What is the Arctic?

The Arctic is a frozen region at the North Pole. In the Arctic there is ice called permafrost covering the ground all year long. There are frozen lakes and rivers, long winters and short summers and storms. The people who live there have houses somewhat like ours. The natives are called Inuit. Many animals live in the Arctic too, and one of the animals is the Caribou.

Appearance

What does the Caribou look like?

The Caribou is a large elk-like animal, that is brown with a white mane called a dewlap. Its body is 127 cm tall at the shoulder. Its tail is 10 to 20 cm long. Its antlers are 147 cm long. It has a long, thick coat. The males are 72 to 78 inches long. The females are a little bit smaller

from the males. The males antlers can be 4 feet from tip to tip. The Caribou's antlers are covered with a hairy skin or "velvet." By fall the velvet has shedded, and it is solid bone. On every pair of antlers there is a main beam. Each main beam has many tines (points) branching off at odd angles. The Caribou does not use its antlers to dig, it uses its forefeet to dig. If the Caribou depended on their antlers for food, they would probably starve. The caribou is a very neat animal

Habitat

Where does the Caribou live?

The Caribou's habitat is in the woodlands or forests of the Arctic tundra. It lives in northern Europe, Asia, Canada, Greenland, Russia, Alaska, Northern, Northern-North America and Arctic islands

to the tree line and Northern [illegible]. The Caribou migrate 40 miles. There are five million caribou in the world and 950,000 in Alaska. The Caribou travel in herds. The Caribou can survive in many cold places.

Family

What is the Caribous family?

The Caribou mothers carry their young for between 210-240 days. They can live 13 years in the wild, and 20 years in captivity. It takes five months for the antlers to grow. The Caribou babies weigh 13 lbs (6 kg), and the older Caribou weigh 350 lbs to 400 lbs. The babies name is a calf. The young are 16 inches tall. The young drinks milk. When it is one month old, it starts to eat plants. The mother raises the young for two years. The

young depend on their parents for food and protection for a short time

Food

What does the Caribou eat?

The Caribou eats lichens, grasses, plants, willow twigs, sedges, flowering tundra plants and mushrooms. It finds its food by pawing the ground of the tundra and traveling to other places. The Caribou are vegetarians. Caribou eat a variety of plants.

Predators

What eats the Caribou?

Some animals eat the Caribou, such as wolves and grizzly bears. The Golden Eagle may attack Caribou young. More animals that eat the Caribou are lynxes, wolverines, coyotes and foxes.

A lot of animals depend on the caribou for food.

Relationship to Man

What is their relationship to man?

The natives in Canada and Alaska depend on the Caribou for food. The Alaskan hunters shoot 22,000 caribou each year! Man is the Caribou's worst enemy. The Caribou has been hunted for centuries, some even for sport hunting. Man destroys the Caribou's habitat. Man eats every part of the Caribou. The flesh provides food and the hide is used for clothing and blankets. The fur itself can be woven or sewn for tents and sleeping bags. The Caribou is a very useful animal.

Other Facts

What are some neat facts about the

Caribou?

-ar bo- means "power or "Shoveler." The Inuits call them tuktu. The Caribou has the biggest antlers of any deer. They have three layers of fat to keep them warm in the Arctic. In the late fall they are clove-brown with white neck, rump and feet. They have a flank strip. The Caribou's lifespan is 13-20 years. In the winter they go to various Arctic regions. In the summer they go back to the Arctic. The Caribou makes many sounds such as, bellows, grunts, snorts, blows, sneezes and coughs. I hope you enjoyed my report and learned a lot about the Caribou.

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