THE NETWORKED STUDENT: A DESIGN-BASED RESEARCH CASE STUDY OF STUDENT CONSTRUCTED PERSONAL LEARNING ENVIRONMENTS IN A MIDDLE SCHOOL SCIENCE COURSE

By

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This design-based research case study applied a networked learning approach to a seventh grade science class at a public school in the southeastern United States. Students adapted emerging Web applications to construct personal learning environments for in-depth scientific inquiry of poisonous and venomous life forms. The personal learning environments constructed used Application Programming Interface (API) widgets to access, organize, and synthesize content from a number of educational Internet resources and social network connections. This study examined the nature of personal learning environments; the processes students go through during construction, and patterns that emerged. The project was documented from both an instructional and student-design perspective.

Findings revealed that students applied the processes of: practicing digital responsibility; practicing digital literacy; organizing content; collaborating and socializing; and synthesizing and creating. These processes informed a model of the networked student that will serve as a framework for future instructional designs. A networked learning approach that incorporates these processes into future designs has

implications for student learning, teacher roles, professional development, administrative policies, and delivery.

This work is significant in that it shifts the focus from technology innovations based on tools to student empowerment based on the processes required to support learning. It affirms the need for greater attention to digital literacy and responsibility in K12 schools as well as consideration for those skills students will need to achieve success in the 21st century. The design-based research case study provides a set of design principles for teachers to follow when facilitating student construction of personal learning environments.

CHAPTER 1
NETWORKED LEARNING AND PERSONAL LEARNING ENVIRONMENTS

Introduction

Web applications offer new opportunities for students to manage information, connect with experts, and synthesize content for learning (Horizon Report, 2009). The challenge lies in preparing learners for a future in which they will access, analyze, and synthesize growing amounts of information as well as increasing human interactions to solve problems effectively and efficiently (Wagner, 2008). This design-based research study of student constructed personal learning environments viewed technology as a partner for learning (Jonassen et al., 2007) rather than a passive repository of information. Its purpose was to facilitate digital literacy and student inquiry through networked learning design principles and structured steps for building the learning environment. A networked student model developed in which teachers facilitate and students take greater responsibility for learning including critical analysis of resources and respectful contact of subject matter experts beyond the classroom teacher.

Networked learning connects students with others in an open, online environment for the purpose of building nodes of human contacts and access to unlimited content from which the student can learn. The terms “networked” and “learning” connote a broad interpretation that could conceivably include any type of learning that takes place with the use of computers connected via a network (Steeples & Jones, 2002). However, the terminology is specifically defined in the field as “learning in which information communication technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors, between a learning community and its learning resources” (Steeples & Jones, 2002, p. 2). The process of organizing these resources is unique to the individual learner. He or she creates a learning environment to meet specific educational needs. Hence, the concept of a personal learning environment (PLE) refers to the methods students use to organize the environment, “the tools they choose, the communities they start and join, the resources they assemble, and the things they write” (Wilson, 2008, p.18). Personal learning environments give learners more control by customizing the learning experience and connecting the learner to others (Downes, 2007). “PLEs are power tools. They empower the powerless to break out of their boxes. PLE’s invite self-directed learning” (Haskins as quoted by Wilson, 2008, p. 19).

Numerous educational technology blogs discuss the potential of personal learning environments in K12 education (Fisch, 2007; Fisher, 2006; Warlick, 2009). Peer-reviewed research is limited, but there is some indication that K12 educators are considering the potential of networked learning. The 2009 Horizon Report sponsored by the New Media Consortium identified the “personal Web” as “a collection of technologies that confer the ability to reorganize, configure, and manage online content rather than just view it; but part of the personal Web is the underlying idea that Web content can be sorted, displayed, and even built upon according to an individual’s personal needs and interests” (Four to Five Years: The Personal Web section, para. 2). The Horizon Report (2009) predicted the time to adoption at four to five years primarily due to filtering policies put in place by K12 administrators to protect students. The Horizon Report (2010) further addressed the efficiencies of personalization. “The implications for informal learning are profound, as are the notions of “just-in-time” learning and “found” learning, both ways of maximizing the impact of learning by ensuring it is timely and efficient" (Key Trends section, para. 3). The filtering issues identified in the 2009 report were substantiated in this study. However, individual schools and districts with liberal acceptable use policies have already been experimenting with blogs, wikis, and other Web-based applications (Richardson, 2008).

This study explored the implementation of networked learning through student construction of personal learning environments (PLEs) in a seventh grade science classroom. The decision to conduct this research in a science class was based on the availability of a willing teacher participant who happened to teach science. Consequently, the scientific research process served as a logical means through which students could pursue self-selected topics in life science. Though, this model could have been applied to other curriculum.

The learner's ability to leverage emerging technologies to effectively pursue educational objectives and self-regulate the learning process revealed implications for both student and teacher.

The Nature of a Networked Learning Environment

Increased responsibility and control on the part of the learner do not necessarily equate to learner motivation (Dede, 1996). Students engaging in this networked learning research must be more self-directed. Not only are they navigating a number of Web-based applications for the first time, they are also required to take an active role in the learning process by making decisions about how to search, where to search, and why certain content meets a learning objective. No longer is there a smooth, charted path that defines what must be done to get an "A". Traditional, lecture-based classrooms are designed as passive learning environments in which the teacher conveys knowledge and the student responds (Chen, 2009). Imagine the potential frustration for students who are quite comfortably accustomed to specific teacher directions with finite expectations.

Teachers, on the other hand, are challenged to provide an appropriate balance between structure and learner autonomy in order to facilitate self-directed learning (Beaudoin, 1990). Such a scenario further presents challenges to traditional forms of assessment. If the learner has primary control, the teacher must consider alternative assessments (Pedersen & Liu, 2003). The role of a teacher within a student-centered approach to instruction is that of a facilitator or coach (Wang, 2006). “He or she supports the students in their search and supply of relevant material, coordinates the students’ presentations of individual milestones of their projects, moderates discussions, consults in all kinds of problem-solving and seeking for solutions, lectures on topics that are selected in plenary discussions with the students and conforms to the curriculum” (Motschnig-Pitrik & Holzinger, 2002, p. 166).

The conventional education system encourages a passive learning style consistent with lecture, textual readings, and test taking (Chen, 2009). Tony Wagner, in his assessment of *The Global Achievement Gap*, goes so far as to say “there is only one curriculum in American public schools today: test prep” (Wagner, 2008, p. 71). Yet, national standards continue to place emphasis on active inquiry as a means of meeting 21st century educational objectives (Partnership for 21st Century Skills, 2007; ISTE National Educational Technology Standards (NETS-S) and Performance Indicators for Students, 2007). The NETS-S specify that students “apply digital tools to gather, evaluate and use information” as well as “use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources" (ISTE National Educational Technology Standards (NETS-S) and Performance Indicators for Students, 2007, p. 1). Such are the tenets of digital literacy. This study happens to take place in a science classroom. The National Science Education Standards (1996, p. 105) state that students "have the opportunity to use scientific inquiry and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments". In this study, networked learning serves as the tool and technique used to thread key 21st Century skills, NETS-S, and science education standards for digital literacy and inquiry.

The Sixth International Conference of Networked Learning was held in 2008 in Halkidiki, Greece. The symposium organizers expressed concern that "now, in networked learning, we are refining and deploying newly available technologies in large part on the basis of what we are technically able to do and not necessarily because of the worth of such opportunities for learning" (Alexander & Booth, 2008). This study is significant in that it attempts to base the design of a networked learning environment on theory and best practices that have been documented thus far.

Problem and Purpose of this Study

Powerful knowledge management capabilities and increased simplicity of emerging Web applications offer potential for K12 networked learning (Horizon Report, 2009). While some teachers experiment with individual tools such as blogs, wikis, and social bookmarking (Richardson, 2008), few if any are implementing full-scale networked learning or combining the use of these digital tools into a framework for student inquiry. Documented examples of K12 personal learning environments are virtually non-existent. Most students do not have the opportunity to apply Web applications for learning. Nor are they guided in the responsible and effective use of these digital tools. In order to provide guidance, teachers must employ instructional design methods that best provide opportunities for students to scaffold learning within a personal learning environment (Hmelo-Silver et al. 2007). Morrison et al. (2007) define instructional design as a systematic process based on "what is known about learning theories, information technology, systematic analysis, educational research and management methods" (Morrison et al, 2007, p. 6). The factors that influence learning outcomes include:

- What level of readiness do individual students need for accomplishing the objectives?
- What instructional strategies are most appropriate in terms of objectives and learner characteristics?
- What technology or other resources are most suitable?
- What support is needed for successful learning?
- How is achievement of the objectives measured? What revisions are necessary if a tryout of the program does not meet expectations? (Morrison et al., 2007, p. 6).

The purpose of this mixed method design-based research study is to apply a networked learning model to the student construction of personal learning environments as a means to facilitate digital literacy and inquiry learning. This first-iteration design captures the nature of the personal learning environment, documents apparent patterns, and considers implications for future instructional design. It seeks to answer the question, what are the processes that students go through as they design a personal learning environment in a middle school science class?

Organization of the Study

Ma and Harmon (2009) provide a step-by-step process for conducting a single iteration of a design-based research study. Step one is the analysis of a practical problem by researchers and practitioners. Step two is the development of a solution within a theoretical framework. Step three is the evaluation and testing of solutions in practice. Step four is the documentation and reflection to produce design principles (Ma & Harmon, 2009).

This study is organized into six chapters that correspond to the design-based research process. Chapter 1 provides an overview of networked learning and personal learning environments. It identifies the research problem and purpose. Chapter 2 presents the literature that informs the design framework of the study and provides a foundation for networked learning. Chapter 3 outlines the design-based research and case study methodology as well as the development of a design solution within a theoretical framework. It is organized according to the steps outlined in the design-based research methodology and includes data analysis as one of those steps. Chapter 4 discusses the findings associated with the nature of personal learning environments in the seventh grade science class. It is divided into two sections. The instructional design solution is tested and evaluated. After which, the main research question of the study is addressed. What are the processes students go through when constructing a personal learning environment to facilitate scientific inquiry? These processes are supported with observation and interview data gathered during the study. Chapter 5 reflects upon the findings and implications. Improvements are suggested for consideration in the design of future networked learning projects. Chapter 6 offers a conclusion, summarizes the benefits of the study, and suggests implications for future research.

Table 1-1. Dissertation format

Chapter	Title	Summary
1	Networked learning and personal learning environments	Introduction to networked learning, how it supports the construction of personal learning environments, and the general significance to the study
2	Literature review	Examines networked learning in the literature including open educational resources and emerging Web technology. A model of the networked student is presented. Constructivism is identified as the theoretical framework.
3	Methodology: development of a design solution within a theoretical framework	The context of the study is described along with the Constructivist Learning Environment Survey. The remainder of Chapter 3 is divided into subsections corresponding to the steps in a design-based research case study.
4	Evaluation and testing of solutions in practice	This evaluation is divided into two sections, instructional design, and the processes students go through in the construction of personal learning environments.
5	Documentation and reflection to produce design principles	Reflects on the findings of Chapter 4 and provides a set of design guidelines for future facilitation of student constructed personal learning environments.

Table 1-1. Continued

6	Conclusion	Presents implications of the design-based research findings as well as suggestions for future research.

CHAPTER 2
LITERATURE REVIEW

Introduction to Networked Learning in the Literature

Ivan Illich wrote *Deschooling Society* in 1970, before the Internet was accessible to most people, before the World Wide Web, and before the personal computer. He identified learning webs made up of all avenues of learning including television, reading, peers, and relationships (Illich, 1970). "We can provide the learning with new links to the world instead of continuing to funnel all educational programs through the teacher" (Illich, 1970, p. 73). Illich recognized the importance of social connections, collaboration, and learner empowerment. He saw that a sense of community beyond the classroom could provide a foundation for deeper learning.

Community is a key factor in networked learning (Goodyear, 2004), but not the only means of making connections. Networked learning is often confused with computer supported collaborative learning (CSCL), computer mediated communication (CMC), and communities of practice (COP) all of which focus on social interactions (Johnson, 2008). But, the central notion of networked learning is in "promoting connections" (Johnson, 2008, p.1). What is done with those connections is at least as important. Johnson indicates a sense of savvy in the accomplished networked learner. "Once a connection is made, requisite skills might include how many connections are tenable, or how to marshal an element of affective intelligence so as to appreciate how even brief messages can chill or foster the network" (Johnson, 2008, p. 4). That sense of savvy extends to resources as well as people (Johnson, 2008).

A foundation in digital literacy is necessary to become an effective networked learner. Digital literacy extends beyond a basic comfort with new technologies. Alkali and Amachi-Hamburger (2004) identify five major digital skills: photo-visual (the ability to make sense of graphical representations), reproduction (create new artifacts from existing content), branching (knowledge construction from hypertext), information (evaluating content), and socio-emotional (interacting effectively with others online). This list may encompass some or most of the skills required to navigate the Internet effectively today. But, the landscape continues to change. A broader definition proposed by Leu et al. (2004) offers greater flexibility.

> The new literacies of the Internet and other ICTs include the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional lives. These new literacies allow us to use the Internet and other ICTs to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others. (pg. 43)

Digital literacy is neither consistently defined nor taught (Moore, 2004). Research indicates students who prefer online learning often have prior knowledge and experience using Web-based tools (Hannafin & Hannafin, 2008). Consequently, the teacher who ventures into networked learning must take on the task of actively teaching digital literacy skills, and these skills change depending upon the content and tools used in the learning process. The student's ability to navigate information sources using online learning tools affects the level of independence associated with the learning process.

Networked learning is student-centered. Control for the learning process is shifted to the student. He or she assumes responsibility for learning goals and the means with which they will be attained (Hannafin & Hannafin, 2008). Web applications and emerging technologies offer new opportunities for students to access, organize, and control learning. Incorporating these tools aids in dissemination of knowledge that is part of the global learning community or collective intelligence (McLoughlin & Lee, 2008). The traditional teacher-centered approach assumes a static knowledge base. With the creative contribution of users in networked learning, knowledge is constantly changing and being presented from different points of view. Decision-making is increasingly important as students determine what content or knowledge is worthy of adding to the networked learning community (Zenios & Goodyear, 2008).

Expanding open educational resources further add to the plethora of content through which learners must sift to piece together an appropriate learning journey. In most cases, educators have designed these resources, some of which include full courses. These open educational resources along with newly available Web technologies continue to create opportunities to further explore and research networked learning from a pedagogical perspective.

Networked Learning and Open Educational Resources (OER)

The convergence of increased ease of access to information and the exponential growth of open source educational resources (OER) provides a new repository of valuable content from which students can learn (Downes, 2007). Open educational resources are "digitized materials offered freely and openly for educators, students, and self learners to use and re-use for teaching, learning, and research" (Hylen, 2006, p. 1). They include scholarly articles, lesson plans, Websites, and fully designed courses posted on the Internet for all to access. The open movement began with MIT's open courseware initiative and continues to spread to other universities and learning organizations (Brown & Adler, 2008). For example, Apple's iTunesU includes course materials and lectures from over one hundred universities including MIT, Stanford, Yale, and Harvard. More are regularly added. The exponential growth of online information poses a challenge to the learner who must locate sources and determine credibility. A major value of open educational resources is the accessibility of content created by professors, teachers, and researchers at reputable educational institutions. In effect, someone else has already collected the resources, put them into a viable format or course, and provided a slightly higher level of confidence that the source is reliable. Apple's iTunesU was originally designed as a portal of open courses offered by participating universities. On July 1, 2008, Apple launched iTunesU-K12 with content from Arizona, Florida, Maine, Michigan, New Jersey, Pennsylvania, and Utah (Jones, 2008). Apple's Continuity of Learning project, launched in the fall of 2009, is an effort to get State Departments of Education and districts posting as much K12 content in iTunes as possible. Teachers are asked to review existing content and create units that pull topics together by state standards. Another initiative including K12 content is Curriki, "an online community created to support the development and free distribution of world-class educational materials to anyone who needs them" (Levy, 2009, p. 1). The Institute for the Study of Knowledge Management in Education (ISKME) created OER Commons in February 2007 "to provide support for and build a knowledge base around the use and reuse of open educational resources" (OER Commons, 2007). OER Commons includes primary, secondary, and post secondary resources, open textbooks, tutorials, lesson plans, and entire courses.

Open educational resources provide free and increasingly reliable access to content. Emerging Web applications provide the tools for organizing, synthesizing, and personalizing that content.

Networked Learning and Emerging Web Technology

Emerging Web applications allow learners to organize content in new ways, create original works, build upon the works of others, and collaborate with experts or communities of learners who share a common goal (Richardson, 2008). Really simple syndication (RSS) offers a means for users to subscribe to changing content such as blogs, wikis, news feeds, podcasts, and video. Synchronous online communication such as video conferencing, microblogging, and instant messaging provide new avenues for reaching experts in any field of study. Digital libraries and searchable repositories of open educational resources (OER) give students access to information on virtually any topic. Functionality mash-ups (Severance et al., 2008) are combinations of Web tools that bring together multiple applications as well as content from multiple sources with a user-friendly interface. Such an interface becomes the personal learning environment (PLEs) that puts structure around the student-constructed synthesis of online content including social connections to other students or subject matter experts.

A number of personal page options such as iGoogle, Netvibes, PageFlakes, and Symbaloo use Application Programming Interface (API) widgets to pull content from external sites and organize it based on user preference. Even libraries including the Atlantic and Birmingham Public Libraries are developing widgets to allow visitors to check out or access books online (Kroski, 2008).

Web applications also provide the means for users to synthesize what they have learned and create new content to share with others. For example, Glogster, a digital poster program, allows students to combine text, graphics, video, audio, and images on any topic imaginable. With so many tools available, those who can manage the tools that manage the content have an advantage. While there is little peer-reviewed research documenting a model, there are numerous teachers and educational technologists blogging about their Web 2.0 experiences.

Educational researcher Alec Couros developed a model of the networked teacher that represents an educator's professional personal learning environment (PLE). Presumably, a teacher will be better equipped to facilitate networked learning if he or she has experienced the construction of such a model first hand. The significant connections in Couros' view of the network include colleagues, popular media, print and digital resources, the local community, blogs, wikis, video conferencing, chat/IRC, social networking services, online communities, social bookmarking, digital photo sharing, and content development communities (Couros, 2008).

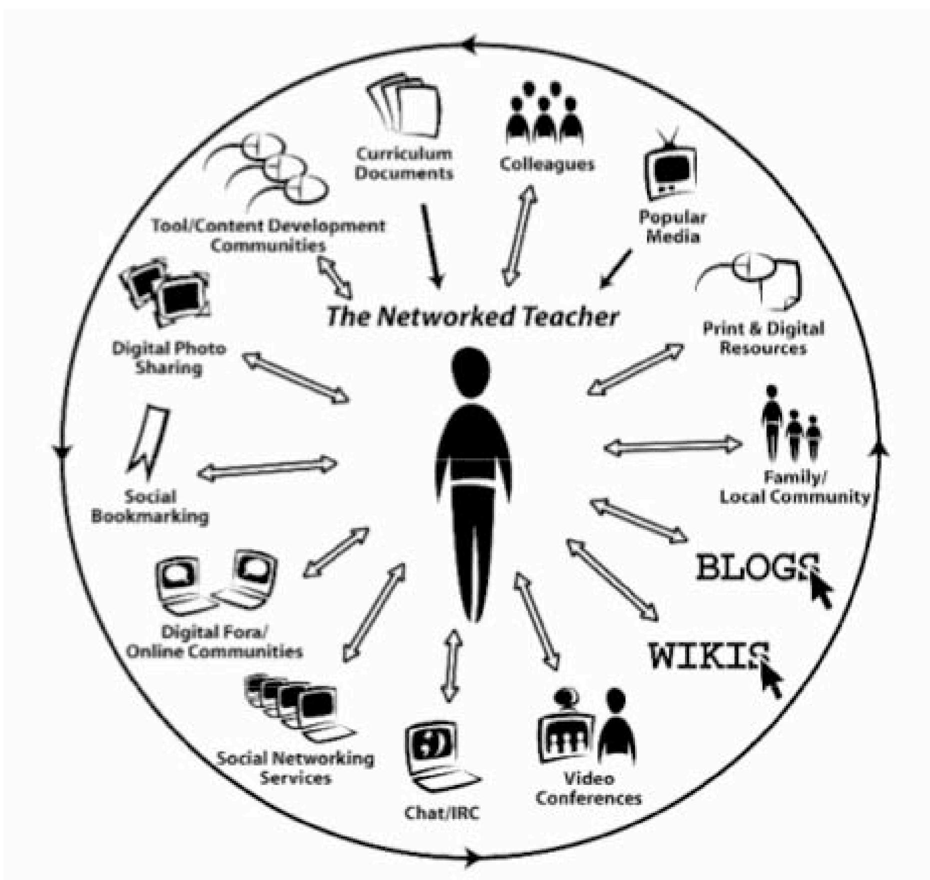


Figure 2-1. The Networked Teacher (Couros, 2008)

It is a model by which teachers begin to build professional connections to support teaching practice. Couros built this model based on feedback from a number of teachers who were actively participating in networked learning for their professional development. He used their input to tweak and revise the model (Couros, 2008). It serves as an example of the numerous connections or nodes that comprise a professional network. Beyond Couros' research, little has been done to explore the impact of such a model from a student perspective, especially in K12 education. This study explores the potential of a networked student model with K12 students.

Developing a Model of the Networked Student

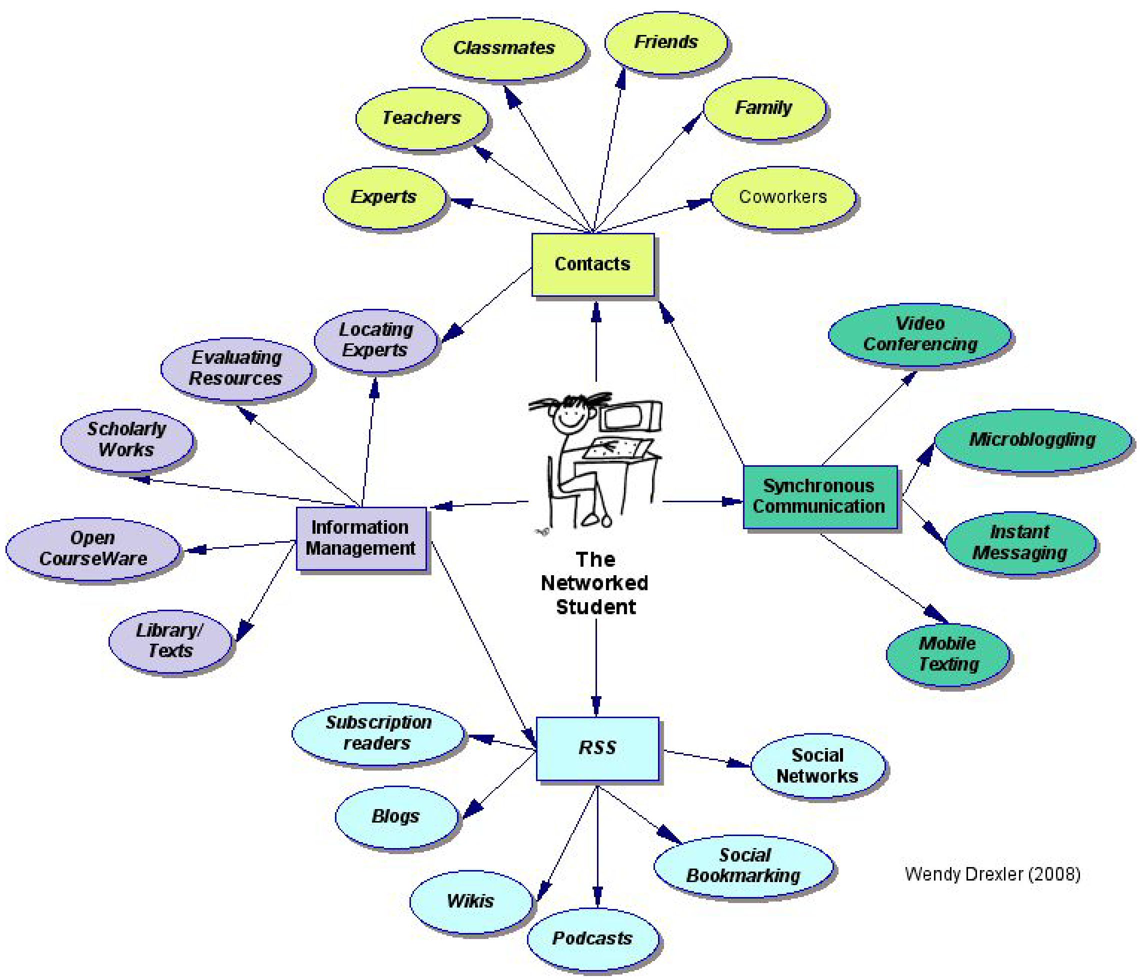


Figure 2-2. The Networked Student

The networked student model includes four primary categories, each with many of the components evident in the networked teacher version. These include academic social contacts, synchronous communication, information management, and really simple syndication (RSS). Social contacts include teachers, classmates, students outside of the class, and subject matter experts. Synchronous communication refers to video conferencing and instant messaging. Information management activities include locating experts, evaluating resources, accessing scholarly works, and finding other open educational resources (OER). RSS encompasses blogging, subscription readers, podcasts, wikis, social bookmarking, and other social networks. Students participating in the research will not necessarily make use of every subcategory; however, this list represents the tools available to the student for constructing a personal learning environment on a specific topic of study.

Constructivism

Networked learning is a complex learning model, different components of which could span a number of established learning theories. For the purpose of this study, unique aspects of the networked learning model were isolated to better address the theoretical framework that informs the research. First, students were expected to access, navigate, disseminate, and synthesize large quantities of information for the purpose of constructing knowledge. Second, students built an environment with technology through which they could learn. They did not learn *from* the technology, but *through* the process of applying it with the goal of constructing a custom personal learning environment (Jonassen, 2003). Constructivism provided the theoretical framework for this research. It implies that knowledge is constructed by the learner and encourages “greater participation by students in their appropriation of scholarly knowledge” (Larochelle et al., 1998).

Constructivism, the foundation of which is attributed to Jean Jacques Piaget, has evolved into at least six different forms: personal (Kelly and Piaget), radical (Glasersfeld), social (Vygotsky), social constructionism (Gergen), critical (Taylor) and contextual (Coburn) (Geelen, 1997). It is in the combination of these theoretical points of view and the “dialectical tension between differing emphasis” that the theory is best applied to practice (Geelen 1997). Generally speaking, constructivism asserts that learners construct knowledge based on their experiences and social interactions (Jonassen et al., 2003). This study was informed primarily by David H. Jonassen’s constructivist perspective applied specifically to solving problems with technology (Jonassen et al., 2003) and Peter Taylor’s critical constructivist perspective of monitoring constructivist classroom learning environments (Taylor et al., 1997).

Jonassen views technology as a collection of tools to support knowledge construction, an information vehicle for exploring knowledge to support learning, a context to support learning by doing, a social medium to support learning by conversing, and an intellectual partner to support learning by reflecting (Jonassen et al., 2003). The key principles are knowledge construction, doing, conversing (or sharing), and reflecting. Each of these components was present in the networked learning model. Students used RSS and social bookmarking to organize information and build upon prior knowledge with the goal of completing a task or meeting a learning objective. Social media, or Web-based applications designed for the purpose of interacting with others online, promoted conversations. Blogs were one example of a vehicle through which students could reflect on the learning process. All of these pieces existed to support a constructive learning experience. The student's personal learning environment pulled them all together.

The ill-defined process reflected in constructive learning (and networked learning) is not always comfortable for the student, especially one who has customarily "engaged in learning activities because they are required, rather than through intrinsic interest" (Jonassen et al., 2003, p. 238). Teacher roles are impacted to the extent that they relinquish some intellectual and management authority while also working to gain familiarity with the technology (Jonassen et al., 2003).

Ultimately, meaningful learning occurs with knowledge construction, not reproduction; conversation, not reception; articulation, not repetition; collaboration, not competition; and reflection, not prescription (Jonassen et al., 2003). Jonassen's perspective of meaningful learning guides the design of constructivist learning environments. The design of the teacher-facilitated, student-created personal learning environment in this study adhered to constructivist principles with the goal of developing a networked student who took increased responsibility for his or her learning while navigating an increasingly complex content base. Creating a learning environment with a culture that supports this student autonomy could be challenging within the cultural myths of a traditional classroom. Taylor et al. (1997) identified these myths as (1) the objectivist view that scientific knowledge embodies universal truths that can be known or discovered and (2) the perceived need to control the classroom environment and view "curriculum as a product that needs to be delivered" (Taylor et al., 1997, p. 295).

Such a teacher-focused perspective failed to take into account the “major cultural restraints that can counteract the development of constructivist learning environments” (Taylor et al., 1997, p. 293). Taylor et al. (1997) suggested taking a critical view of constructivism that addressed the cultural perceptions of the learning environment. Open discourse between teacher and student provide a learning environment that is empowering and negotiable. To achieve this goal, Taylor developed and refined the Constructivist Learning Environment Survey with “five key dimensions of a critical constructivist learning environment: personal relevance, uncertainty, critical voice, shared control, and student negotiation” (Taylor et al., 1997, p. 296).

Networked learning as it is applied to the construction of personal learning environments adopts the view of student empowerment and negotiation. The constructivist and critical constructivist theories support student autonomy and inform the design methodology for this study.

CHAPTER 3
METHODOLOGY: DEVELOPMENT OF A DESIGN SOLUTION WITHIN A THEORETICAL FRAMEWORK

Introduction

The purpose of this mixed method design-based research study was to apply a networked learning model to the student construction of personal learning environments as a means for facilitating digital literacy and inquiry learning. It sought to answer the question, what are the processes that students go through as they design a personal learning environment in a middle school science class? The design process was documented from both an instructional and student design perspective. While the focus of the research was on the process implemented by the student, it was necessary to present the supporting instructional design to better understand the student behaviors. Taylor's (1997) Constructivist Learning Environment Survey (CLES) was nested within a design-based research model to further inform the study and identify the learning environment as constructivist. The CLES is a quantitative tool that measures student perceptions of the learning environment. Design-based research is a qualitative method especially useful when "exploring novel learning and teaching environments, developing theories of learning that are contextually based, advancing design knowledge, and increasing capacity for educational innovation" (Hoadley, 2003, p. 8). It is valuable in its ability to inform and improve educational practice (Hoadley, 2003). Yin (2009) refers to this format as a mixed-method nested arrangement and supports its use in broad or complex research designs.

Context

The study took place in a seventh grade science class in a K12 public school in the southeastern United States. The school demographics at the time of the study were

24% African-American, 3% Asian, 51% Caucasian, 16% Hispanic, and 5% Multi-racial. It had a 21% free and reduced lunch rate.

The teacher in this study (Mr. H) taught 110 students in 5 seventh grade science classes encompassing all seventh grade students at the school. His school principal recommended him for the study based on his constructivist methods, flexibility, and open-mindedness toward new technologies. Prior to this project, he had incorporated some streaming video and a few Web-based applications such as wikis and Skype into his curriculum. He was not familiar with the formal definition of networked learning or personal learning environments. Nor was he familiar with most of the Web applications employed in the study. His classroom was filled with class pets including a chameleon named Sarah and a bearded dragon named Zoey. Students were encouraged to interact with the animals once they had proven their knowledge of how to properly care for them. Mr. H's teaching philosophy incorporated hands on activities, science experiments, and strong encouragement to socialize and communicate with classmates as an integral part of the learning process.

Researcher journal entries and teacher observations were focused on one of Mr. H's 5 classes. Two students were selected by the classroom teacher for detailed observation and data collection, one identified by the teacher as a self-regulated learner, the other identified as needing considerable structure and support. This selection was reinforced by state standardized reading test scores. The student identified as a self-regulator had above average reading scores while the other student had below average reading scores.

Constructivist Learning Environment Survey (CLES)

The Constructivist Learning Environment Survey (CLES) was administered to all students in seventh grade science on the first day of the school year. Students were asked to respond based on science classes they had the previous year. The CLES was re-administered to all students at the end of the nine-week networked learning project.

The Constructivist Learning Environment Survey (CLES), developed by Peter Taylor and Barry Fraser, "monitors the development of constructivist approaches to teaching science and mathematics" (Taylor et al., 1997, p. 295). Five scales are measured:

- Personal Relevance Scale - connectedness of school science to students' out-of-school experiences, and with making use of students' everyday experiences as a meaningful context for the development.
- Uncertainty Scale – extent to which opportunities are provided for students to experience scientific knowledge as arising from theory-dependent inquiry involving human experience and values, and as evolving, non-foundational, and culturally and socially determined.
- Critical Voice Scale – extent to which a social climate has been established in which students feel that it is legitimate and beneficial to questions the teacher's pedagogical plans and methods, and to express concerns about any impediments to their learning.
- Shared Control Scale – concerned with students being invited to share with the teacher control of the learning environment, including the articulation of learning goals, the design and management of learning activities, and the determination and application of assessment criteria.
- Student Negotiation Scale – extent to which opportunities exist for students to explain and justify to other students their newly developing ideas, to listen attentively and reflect on the viability of other students' ideas, and, subsequently, to reflect self-critically on the viability of their own ideas.
(Taylor et al., 1997, p. 296).

The CLES was revised in 1996 and, each scale was tested for reliability with 1600 Dallas students in 120 grade 9-12 science classes. Using the Cronbach alpha coefficient, the “lowest reliability value was .64 for uncertainty, but values for all other scales exceeded .80” (Taylor et al., 1997, p. 298).

The CLES survey informed the instructional design and lessons associated with the facilitation of student personal learning environments constructed for this study. The goal was to determine whether students perceived the learning environment as constructive. The CLES was administered on the first day of class to determine student perceptions prior to the project and again at the end of the nine-week research period to see if there was any change in perception. The CLES question headings further indicated areas for the teacher to concentrate his efforts in trying to create an environment in which students learn about the world, learn about science, learn to speak out, learn to learn, and learn to communicate (Taylor et al., 1997).

Design Based Research

“Design experiments” were first introduced by Ann Brown (1992) and Allan Collins (1992) and created as a means to “carry out formative research and to test and refine educational designs based on principles derived from prior research” (Collins et al., 2004, p. 15). This has since come to be known as design-based research (Collins et al., 2004). Steps in the process include analysis of practical problems, development of solutions informed by existing design principles and technological advances, iterative cycles of testing and refinement, and reflection to produce design principles (Reeves, 2006).

Iterative cycles of design take time. *Design-Based Research and Doctoral Students: Guidelines for preparing a dissertation proposal* suggests a 4-year timeline in order to complete at least three iterations in the design process (Herrington et al., 2007). Yuxin Ma and Stephen Harmon offer a case study of design-based research for individual iterations adapted from Reeves' (2006) steps (Ma and Harmon, 2009). The research benefit of a first-iteration design study is the concise, step-by-step process for analyzing the problem, developing a solution, testing the prototype, and reflecting on the results (Ma & Harmon, 2009). Practically speaking, a single-iteration design condenses the dissertation into a manageable timeline with well-documented results to inform future iterations and provide implications for further research.

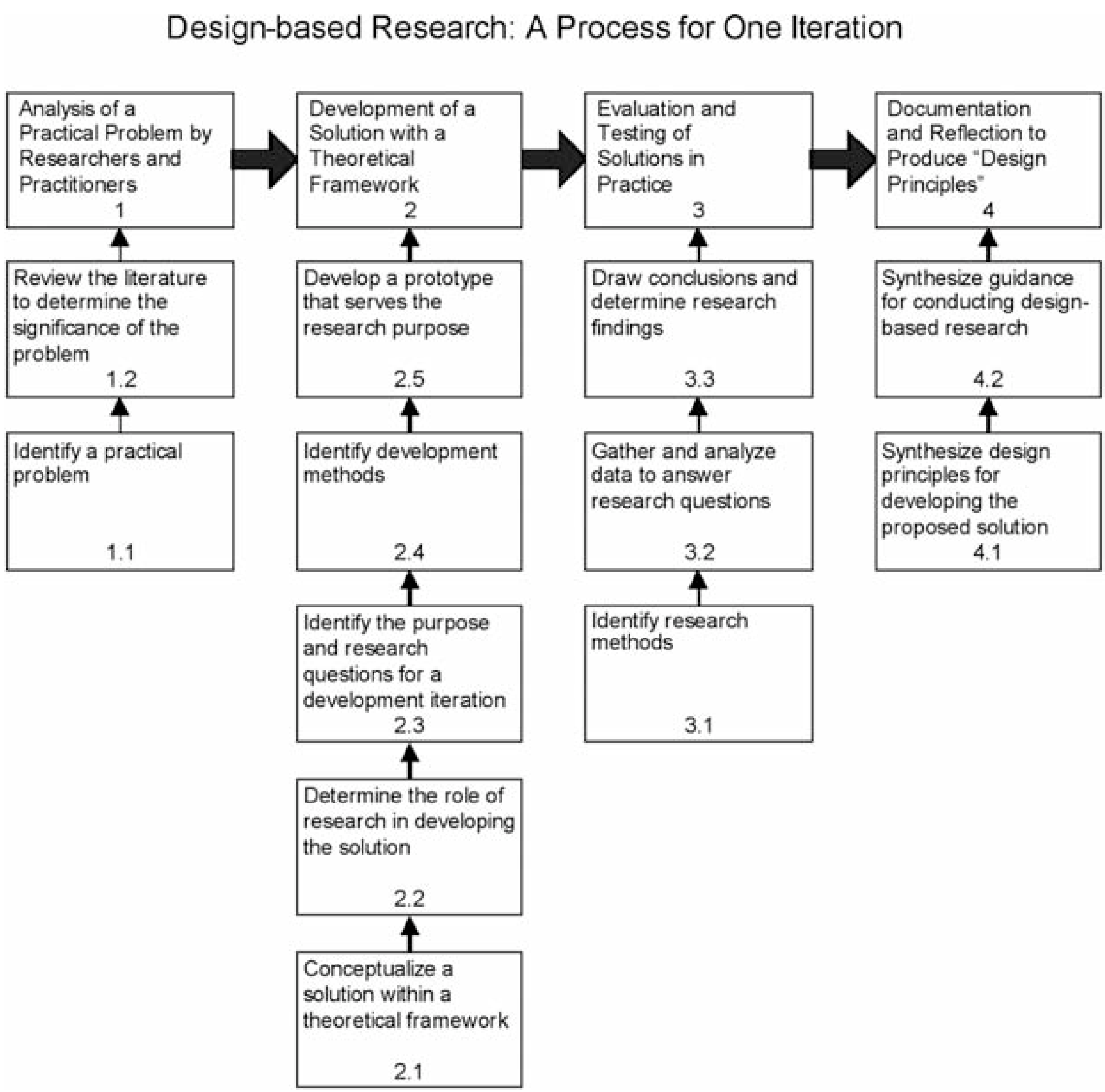


Figure 3-1. Design Based Research: A Process for One Iteration (Ma & Harmon, 2009, p. 77)

The following outline follows the steps highlighted in Figure 3-1 as they were applied to this design-based research study of student-constructed personal learning environments. The next section summarizes the steps of design-based research employed in this study, some of which will be elaborated on in chapters 4, 5, and 6.

1.1 Identify a Practical Problem.

Chapter 1 identified the practical problem. Powerful knowledge management capabilities and increased simplicity of emerging Web applications offer greater potential for K12 networked learning (Horizon Report, 2009). While some teachers experiment with individual tools such as blogs, wikis, and social bookmarking (Richardson, 2008), few if any are implementing full-scale networked learning or combining the use of these digital tools into a framework for student inquiry. Documented examples of K12 personal learning environments are virtually non-existent. Consequently, students do not have the opportunity to apply web applications for learning. Nor are they guided in the responsible and effective use of these digital tools.

1.2 Review the Literature to Determine the Significance of the Problem.

Chapter 2 established a connection between the literature and networked learning. Digital literacy is identified as an important foundation for successful networked learning. Emerging Web applications in combination with increased access to open educational resources provided a climate ripe for networked learning and the construction of complex personal learning environments used to organize these tools. A model of the networked student that integrates RSS technology, information management, personal contacts, and synchronous communication was needed to maximize the benefits of an increasingly complex networked learning challenge.

2.1 Conceptualize a Solution within a Theoretical Framework.

Constructivism informed the design of student constructed personal learning environments. Taylor's (1997) Constructivist Learning Environment Survey (CLES) is based upon critical constructivism and measures student perceptions on five scales: personal relevance, uncertainty, critical voice, shared control, and student negotiation. Within this framework, the networked teacher and networked student models support a constructivist design that influences the teacher's direct instruction and the student's organization of the personal learning space. Chapter 2 provided the theoretical framework and introduced these models.

2.2 Determine the Role of Research in Developing the Solution.

The role of this research was to develop a first-iteration design for the student construction of personal learning environments to promote digital literacy and facilitate student inquiry. It took place in a 7th grade science classroom, but established a practice of networked learning that could be applied across different curricula. It captured the nature of the personal learning environment, documented apparent patterns, identified implementation issues, and considered implications for future design.

2.3 Identify the Purpose and Research Questions for a Development-Iteration.

The purpose of this mixed method design-based research study was to apply a networked learning model to the student construction of personal learning environments as a means to facilitate digital literacy and inquiry learning. It sought to answer the question, what are the processes that students go through as they design a personal learning environment as a means of inquiry in a middle school science class?

2.4 Identify Development Methods.

The development methods included the instructional design steps taken to create the personal learning environment prototype. These development methods are further described in section 2.5. Networked learning design and the networked student model were included here because they provide the basis for development. Networked learning design (Goodyear, 2005) informed the networked student model as described in Chapter 2 which served as the foundation for the prototype.

Networked learning design is broken down to include tasks, organizational forms, roles, and learning environment tools and resources (Goodyear, 2005). The tasks describe what the students are to do in order to meet the learning objective. Organizational forms identify how students are grouped. Roles reflect each student's job within the group. Students may also conduct their research as individuals. Tools are the digital Web applications or resources aggregated by the student to construct the personal learning environment.

Table 3-1 offers some examples of tasks, organizational forms, roles, and tools. This is by no means a complete list, but serves as an example. Items from each category were mixed and matched to meet the needs of the learning objective (Goodyear, 2005). These tasks, organizational forms, and tools were incorporated into individual lessons to maximize the effectiveness of the networked learning unit. For example, one objective within the personal learning environment required the student to partner with another working on the same topic (organizational form – dyad) to compare and contrast (task) their scientific hypotheses. Each posted a description of his or her hypothesis on a personal blog (tool) to which the other responded (task) with a comment. The student assumed two roles in this process, one of defender who posts and defends the hypothesis, and one of responder who questions and offers suggestions. Taking the time to think through the tasks, forms, tools, and roles adds structure to learning goals and guards against the use of tools in the absence of educational objectives.

Table 3-1. Patterns for networked learning (Goodyear, 2005, p. 1)

Tasks	Organizational forms	Learning environment (tools, resources)
Discuss	Dyad	Self selecting group
Debate	Triad	E-print
Brainstorm	T-group	E-journal
Investigate	Learning set	Virtual library
Critique	Tutorial group	Discussion board
Assess	Seminar group	Chat room
Summarize	Whole class cohort	White board
Solve puzzle	Project Team	Shared folder
Write essay		Wiki
Develop tool	Roles:	Virtual Café
Memorize	Summarizer	Portal
	Motivator	

For this study, the learning environment (tools and resources) column is further expanded below to include the four primary components of the networked student model discussed in Chapter 2 (social contact, synchronous communication, information management, and really simple syndication). Some tasks, organizational forms, tools and resources were also integrated.

Table 3-2. The Networked Student components

Contacts	Information management	Really Simple Syndication (RSS)	Synchronous communication
Experts	Locating experts	Subscription readers	Video conferencing
Teachers	Evaluating resources	Blogs	Microblogging
Classmates	Scholarly works	Wikis	Instant messaging
Friends	Open Courseware	Podcasts	Mobile texting
Family	Library	Social bookmarking	
Coworkers (if applicable)	Texts	Social networks	

All of these components were brought together using Symbaloo™, a personalized Web page. An aggregator such as Symbaloo™ was necessary to manage the content coming from each of the networked student components. While a number of Web-based applications were available to meet student needs in each category, the options were limited by age. Many applications specified in the terms of service that students be at least 13 years of age to use the tool. Therefore, it was imperative that terms of service be evaluated prior to introducing Web applications to students under 13.

2.5 Develop a Prototype that Serves the Research Purpose.

The prototype developed for this case study represented the personal learning environment constructed by the student. It encompassed the instructional design and student activities that supported the final product. Section 2.4 identified the components of the networked student personal learning environment. Students were new to these components as well as the tools that supported them; therefore, a significant amount of time and structure was required to teach the students how to use the tools and how they fit within a learning framework. The unit plan (Table 3-3) highlights the steps taken in this process. A prototype was developed representing how a student might construct his or her personal learning environment within the context of a self-selected topic in seventh grade life science (Figure 3-2.). This is merely an example, as each student constructed and organized the desktop to his or her liking. In this prototype, the six icons in the upper left corner of the desktop are custom designed by the student. Clicking on the sand hill crane takes the student to NoteFish notes. The icon on the right navigates to the Delicious social-bookmarking account. The icons in the next row below link to the student's blog, RSS alerts, and the Glogster project respectively. All remaining icons are options through which the student connects to other relevant sites.

Table 3-3. The Networked Student unit plan

The Networked Student unit plan – 9 Weeks

Unit objective**:** The student will model the scientific method through the construction of personal learning environments to research a self-selected topic in life science.

Preparation – 2 weeks

- Teacher introduces the scientific method, what it means to be a scientist, and how to think like a scientist. Students embark on a scientific exploration based on the scientific method. Each student selects his or her topic of study, conducts a KWL (what you know, what you want to know, what you learn), and establishes a research question and hypothesis.
- Acceptable/Responsible Use Policy is discussed and signed by each participating student.
- The project is positioned within the following perspective. What if your teachers disappeared and you had to learn on your own? Would you give up on learning? Where would you begin? Why would learning be important? You are an empowered learner. You have the power to learn anything. How much you learn is up to you. How you manage your learning is up to you. How you manage your time is up to you. A big part of your success will depend on how well you are organized.

Introduction of tools – 2 weeks

Web applications are introduced one at a time to give students the chance to master the tool within the context of the study topic. Digital literacy is integrated into these lessons as needed. The essential questions of digital literacy are presented. Where can you go for good information? How do you know if you can trust what you find? How will you find subject matter experts you can trust to help you learn? Why is reflection important when you are learning something new? Why is it important to share what you've learned? How will you share?

Web application (Networked Student component)	Tool used in prototype	Student activity Level of structure
Social Bookmarking (RSS)	Delicious http://delicious.com/	• Explain Really Simple Syndication (RSS) and evaluation of Websites • Set up the account • Subscribe to each others accounts • Bookmark and read at least 5 reliable websites that reflect the content of chosen topic • Add and read at least 3 additional sites each week.

•
•
•

Table 3-3. Continued

Note taking (Information Management)	NoteFish http://www.notefish.com	• Create NoteFish account • Begin content collection
News and blog alert (RSS)	Google Alert http://www.google.com/alerts	• Create a Google Alert of keywords associated with selected topic • Read news and blogs on that topic that are delivered via email daily • Subscribe to appropriate blogs in reader
Personal web aggregator (RSS, Information management)	Symbaloo http://symbaloo.com	• Introduce Symbaloo • Customize page • Start by creating a social bookmarking gadget • This will build as students learn new tools
News and blog reader (RSS)	Symbaloo RSS Feeds http://symbaloo.com	• Search for blogs and newsfeeds devoted to chosen topic • Subscribe to blogs and newsfeeds to keep track of updates. Set up gadgets in Symbaloo
Personal blog (RSS)	EduBlogs http://www.edublogs.org	• Create a personal blog • Post a personal reflection each day of the content found and experiences related to the use of personal learning environment • Students with similar topics subscribe to each others blogs in reader
Internet search (Information management, contacts, and synchronous communication)	Google Scholar http://scholar.google.com/	• Conduct searches in Google Scholar and library databases for scholarly works. • Bookmark appropriate sites • Consider making contact with expert for video conference

Table 3-3. Continued

Podcasts (RSS)	iTunesU http://www.apple.com/itunes/whatson/itunesu.html	• Search iTunesU for podcasts related to topic • Listen to at least 2 podcasts if possible
Video conferencing (Contacts and Synchronous Communication)	Skype http://www.skype.com	• Identify at least one subject matter expert to invite to Skype with the class.
Daily research, reflection, share 3 weeks Once the personal learning environment is constructed, the student will continue to conduct research and navigate new content on a daily basis. Daily activities should be divided between introducing a tip or offering a research theme for the day, actual time spent conducting research, ten minutes to reflect, and 15 minutes to share		
Content synthesis- 1 to 2 weeks	Glogster http://www.glogster.com	• Digital science poster in Glogster to reflect student research within the context of the scientific method

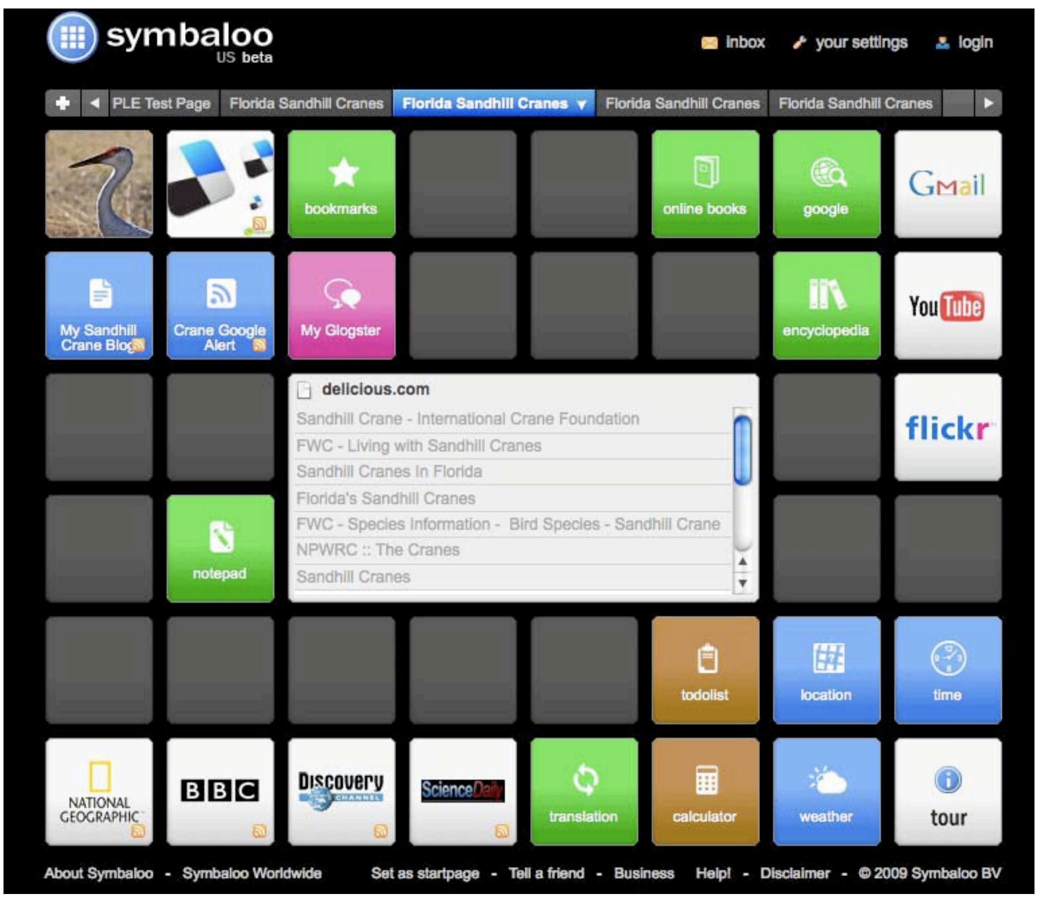


Figure 3-2. Prototype of Symbaloo personal learning environment

3.1 Identify Research Methods.

This mixed method case study included a quantitative instrument administered for the purpose of evaluating the constructivist learning environment before and after participating in the networked student project. The pre-survey established the students' perception of the constructivist learning environment in their previous sixth grade science class. The post-survey identified whether the students perceived their current science class as constructivist and whether there was a significant change in these perceptions between the pre and post-surveys. The Constructivist Learning Environment Survey (CLES) measured student perceptions within five scales: personal relevance, uncertainly, critical voice, shared control, and student negotiation. It consisted of 25 questions with 5 questions in each of the 5 scales. The tool was applied to inform the instructional design in an effort to create the optimal constructivist learning environment, and as a measure of student perceptions of the networked learning experience.

The survey was administered to 96 seventh grade science students in 5 classes within the first week of school to document their perceptions prior to engaging in the networked learning project. It was administered again at the end of the project. Results were compared to determine whether student perceptions of the constructivist environment changed as a result of participation. Studies from Taylor (1997) indicated that "more reliable responses would likely be obtainable from students if the CLES (1) focused students' attention on the specific learning environment of interest and (2) made the process of responding to items a more meaningful activity" (Taylor et al., 1997, p. 297). In response to these concerns, the students were directed to respond to items based on their participation in the networked learning project. They were also advised as to the importance of thoughtfully responding to each question.

Qualitative data were collected and analyzed based on Robert K. Yin's Case Study Research Design and Methods Fourth Edition (Yin, 2009). Yin identified six possible sources of evidence: documentation, physical artifacts, interviews, direct observations, participant-observation, and archival records (Yin, 2009). For the purpose of this case study of student construction of personal learning environments, documentation included the unit plan, teacher lesson agendas, student notes, teacher emails, researcher field notes, subject matter expert responses to student projects, and CLES results. Physical artifacts included the personal learning environment as constructed by the student using Symbaloo, personal blogs, scientific reports, and final Glogster projects. In-depth interviews were conducted with the teacher over time and in one final recorded and transcribed hour-long session. The teacher served as informant, providing "insight and corroboratory or contrary sources of evidence" (Yin, 2009, p. 106). Focused interviews were conducted with the students at the close of the study based on "a set of questions derived from the case study protocol" (Yin, 2009, p. 107).

Direct observations of one class were conducted over nine weeks. The middle school was on block scheduling to allow for more uninterrupted instruction time. All classes met on Mondays for 45 minutes each. For the remainder of the week, half the classes met on Tuesdays and Thursdays for 1 hour and 40 minutes each. The others followed the same schedule on Wednesdays and Fridays. The selected class in this study was observed for a total of 18 days (31 hours) over nine weeks of contact time.

Field notes were taken and analyzed to inform a protocol of behaviors that further informed the nature of networked learning in a seventh grade science class. Data triangulation was accomplished through the collection of data from multiple sources including documentation, physical artifacts, interviews, and direct observation.

The researcher's role was one of collaborative participant observer (Merriam, 1998). As such, the researcher worked hand in hand with the classroom teacher to assist in the instructional design of the networked learning project serving as a coach and consultant. The students were aware of the researcher's role as a collaborative participant. Typically, the investigator and the participants are equal partners in the research process including defining the problem to be studied, collecting and analyzing data, and disseminating the findings" (Merriam, 1998, p. 101). In this case, the researcher worked collaboratively with the teacher, and in some cases as a co-facilitator with the students, however; data analysis and dissemination of findings were the sole responsibility of the investigator. The primary ethical consideration was whether the researcher's involvement in a major class project was detrimental to the learning process or swayed the students' approach because they knew they were being observed. The researcher's goal was to keep a low profile and interfere as little as possible in the learning process unless questioned directly by the students. A draft of the findings specific to the classroom teacher and student observations was shared with the teacher to verify his perception of the results.

3.2 Gather and Analyze Data.

Yin identifies four general analytic strategies appropriate for a case study: relying on theoretical propositions, developing a case description, using both qualitative and quantitative data, and examining rival explanations (Yin, 2009). This study applied the most desirable strategy, relying on the theoretical propositions that inform the research questions (Yin, 2009) and the use of both qualitative and quantitative data. It was based on constructivism as a valid theory of learning. The underlying proposition assume that student construction of personal learning environments is a valid constructivist approach and conducive to student learning. Therefore, data collection focused on constructivist principles. A second analytic strategy, using both qualitative and quantitative data, was made possible through the use of the Constructive Learning Environment Survey (CLES). Through this instrument, the researcher verified whether students perceived the personal learning environment as constructive.

Documentation data were organized first by "developing a matrix of categories and placing the evidence within such categories" (Huberman as quoted by Yin, 2009). From these matrices, the data were open coded to further identify themes that emerged from the data (Hoepfl, 1997). Axial coding was conducted to determine how the themes were linked and to understand the construction of personal learning environments as a potential learning tool (Strauss and Corbin, 1990). The levels of coding were an iterative process. As patterns became evident, new codes were established and data were revisited to determine how they fit into the new categories. Appendix A provides an overview and example of the coding process and HyperResearch documentation.

The list below shows the pattern of codes and how they fit within emergent themes that supported the research question, what are the processes students go through as they design a personal learning environment as a means of inquiry in a middle school science class.

Themes Derived from Codes

Practicing digital literacy

- Following technical procedures
- Searching and viewing images
- Searching and viewing text
- Searching and viewing video
- Note taking
- Reading/comprehending online text
- Questioning content
- Cutting and pasting

Practicing digital responsibility

- Posting or accessing inappropriate content
- Using technology inappropriately

Organizing content

- Setting up user accounts
- Adding widgets in Symbaloo
- Rearranging Symbaloo page
- Setting up a wall in Glogster
- Editing text in scientific report

Dealing with technology

- Systemic
- Web application related
- Distracted by technology
- Expressing frustration
- Expressing positive feelings toward technology
- Identifying favorite technology
- Perceiving learning with technology
- Reacting to technology
- Reflecting on past use of technology

Collaborating and socializing

- Class socializing
- Communicating with other student(s)
- Helping other student(s)
- Questioning other student
- Questioning teacher

Synthesizing/Creating

- Reflecting on being a scientist
- Writing on blog
- Writing scientific report (Google Docs)
- Creating digital poster (Glogster)
- Revising with feedback from subject-matter expert

Taking responsibility and control for learning

- Distracted by others
- Distracting others
- Engaging in assigned task(s)
- Multitasking
- Perceiving control
- Perceiving workload
- Self-regulated start of class
- Self-regulating resumed
- Showing excitement for learning
- Taking different approaches
- Working outside of class

An additional theme, constructing knowledge, was identified as evidenced by the results of the Constructivist Learning Environment Survey. Findings are reported in detail in Chapter 4. Teacher behaviors were also coded, some of which did not apply directly to the research question as it pertains to the processes students go through. However, it was helpful to analyze these behaviors and how teacher instructions and decisions affected the student processes. The codes collected for teacher processes included: instructing, integrating face-to-face with digital learning, perceiving teaching with technology, commenting on project, and teaching content.

3.3 Draw conclusions and Determine Research Findings

Chapter 4 provides a discussion of findings associated with the nature of personal learning environments in the seventh grade science class. The findings are presented in two sections. First, an evaluation and testing of the instructional design solution provides an overview of what actually took place in the classroom as the teacher made adjustments based on the daily needs of the project. Second, the research question is answered. What are the processes students go through when constructing personal learning environments to facilitate inquiry learning in a seventh grade science course? Detailed codes and themes are identified based on observations, interviews, and artifacts. Evidence from the data is offered to support each of the processes.

4.1 Synthesize Design Principles for Developing the Proposed Solution

In design-based research, synthesis of design principles is important for the development of follow-on projects and future iterations of the learning solution. Chapter 5 of this study focuses on lessons learned and how the literature applies to findings of the study.

4.2 Synthesize Guidance for Conducting Design-Based Research

Chapter 5 also provides guidance for further iterations of student constructed personal learning environments, as well as recommendations for conducting future research. Chapter 6 in the dissertation presents conclusions and implications for policy and practice.

Ma and Harmon's design-based research flow chart depicts the process as linear and sequential (Ma and Harmon, 2009). In reality, the design process is iterative (Ma and Harmon, 2009). As the teacher and students progressed through the construction of personal learning environments, the teacher made necessary adjustments to instruction and the student altered the personal learning environment to meet his or her project needs. The researcher observed patterns that potentially informed the design and how instruction might change from day to day in response to those patterns.

CHAPTER 4
EVALUATION AND TESTING OF SOLUTIONS IN PRACTICE

The research goal of this study was to apply a model of networked learning to the student construction of personal learning environments as a means to facilitate digital literacy and inquiry learning. This first-iteration design captured the nature of the personal learning environment, documented apparent patterns, and considered implications for future design. It sought to answer the question, what are the processes that students go through as they design a personal learning environment as a means of inquiry in a middle school science class?   In the interest of meeting these goals, the findings are reported in two sections, the first based on an evaluation and testing of the design solution in practice, the second on the student processes that inform future instructional design.

Evaluation of the Instructional Design

The instructional design of the study was based on Goodyear's (2005) patterns for networked learning and the framework of the networked student model (Drexler, 2008).

Goodyear (2005) identifies patterns of networked learning based on various combinations of tasks, organization forms, and learning environments. The networked student model presented the nodes or avenues for learning made possible by a networked learning approach. These included human contacts, information management, access to content made possible by Really Simple Syndication (RSS), and synchronous communication.

The primary educational objectives of a 9-week unit of study were to model the scientific process. Secondary educational objectives were to differentiate between poisonous and venomous creatures and conduct an authentic inquiry into a student-selected example. The scientific process differs from the traditional steps of the scientific method in that it broadly includes how scientists think, the types of questions they ask, and the process they go through when approaching a scientific problem or challenge (Hume, 2009).

The students had never participated in networked learning, so a significant amount of time was allotted at the beginning of the project to address digital literacy skills. These are outlined in greater detail in the student processes section of Chapter 4. A number of combinations of Goodyear's (2005) patterns for networked learning were applied in the preparation and implementation phases of the unit.

Selecting from tasks, organizational forms, and learning environments in the table below, the teacher differentiated instructional strategies and student activities. These were modeled in the classroom environment before moving to contacts outside the classroom.

Table 4-1. Patterns for networked learning (Goodyear, 2005, p. 1)

Tasks	Organizational forms	Learning environment (tools, resources)
Discuss	Dyad	Self selecting group
Debate	Triad	E-print
Brainstorm	T-group	E-journal
Investigate	Learning set	Virtual library
Critique	Tutorial group	Discussion board
Assess	Seminar group	Chat room
Summarize	Whole class cohort	White board
Solve puzzle	Project Team	Shared folder
Write essay		Wiki
Develop tool	Roles:	Virtual Café
Memorize	Summarizer	Portal
	Motivator	

The following examples are not an exhaustive list, but provide an overview of how the patterns were applied for the study. Within the classroom environment, students were set in table groups of 4. At various times, they were partnered across table or with shoulder partners to peer-review and critique assignments. Debate played a significant role in the assessment and evaluation of websites. Students took sides to determine whether or not a site was valid and reliable. Students had to continually assess the validity of sites as they completed group and individual work. This work could be conducted within a number of learning environments. Most responses to debates were constructed in self-selecting groups based on individual opinions. Students chose sides depending upon whether they supported or refuted the validity of a given resource. Discussions took place online using a variety of tools including chat and online whiteboards. Ultimately, subject matter experts were located and contacted via email or video conferencing for feedback and critique during the research process.

Selecting the appropriate learning environment and organizational form for a given task was a key instructional design consideration based on the teacher and researcher's prior experience and educational background. Adjustments were made in progress to best meet the learning needs of the students. Appendix D outlines the agenda activities as presented to the students for each class period during the nine-week project. Educational standards (Appendix C) were derived from the Florida Next Generation Sunshine State Standards (2008), the National Science Education Standards (1996), and the International Society for Technology in Education National Educational Technology Standards for Students (2007). A review of Appendix D is suggested to better understand what took place in the classroom, the standards covered, and the level of structure incorporated in this first iteration design.

Key design considerations were evident in the daily agenda postings. This first iteration networked learning solution assumed students had no prior experience constructing personal learning environments for inquiry learning. Therefore, increased structure was needed to model and scaffold the learning process. Daily assignments began with greater structure in the initial weeks of the project and offered increased flexibility as the inquiry progressed. A significant amount of time was allotted initially to set up Web application accounts and practice digital literacy. Since there was no textbook in use, the teacher provided essential questions and built examples such as YouTube videos and class or group discussions to introduce concepts. The teacher also took advantage of social interaction within the class by having students collaborate and peer review the work of other students before encouraging them to contact subject matter experts outside the classroom.

As the project continued, agenda items included more activities from previous posts. Students were encouraged to work at their own pace and take on increased responsibility for monitoring and conducting the learning process. Some students finished assignments quickly. Others required more time. The agenda was designed to include both whole-class involvement and individually paced progress.

Throughout the daily lessons, the teacher was mindful of the delicate balance required to achieve the greatest level of student autonomy and independence while maintaining the optimal learning potential of the project. An inquiry-based strategy was implemented in which the teacher applied structured, guided, and open inquiry activities

(Colburn, 2000). The Pocket Tanks scientific report serves as an example of structured inquiry in which the students were given step-by-step instructions for conducting an exploration. In guided inquiry, the teacher provides the problem and directs the students to the materials for investigation (Colburn, 2000). The research conducted to differentiate between poisonous and venomous creatures is a guided inquiry example. Ultimately, the students experienced an open inquiry model in which they were able to select a poisonous or venomous animal to research in greater depth.

Organization of the networked learning environment was another key design element. The student construction of his or her personal learning environment was heavily dependent upon the activities assigned by the teacher. The goal of networked personal learning is to create an environment in which the student has considerable control over the learning process. However, this first iteration design took into account the age of the learner and his or her lack of experience with most of the Web applications used to create the personal learning environment. The networked student model is complex in that the learner must organize content from a variety of sources including human contacts and informational resources. Really Simple Syndication (the ability to subscribe to changing content on the Internet) and synchronous communication tools facilitate access to valuable content, but provide minimal organizational options. The recent development of API widgets made it possible to create a personal page on which content could be pulled from a number of other online resources. The user determined what content should be included. Examples of online personal pages include iGoogle, NetVibes, PageFlakes, and Symbaloo. The latter was chosen because it was the only application with terms of service that allowed children under the age of 13 to use the tool with parental permission.

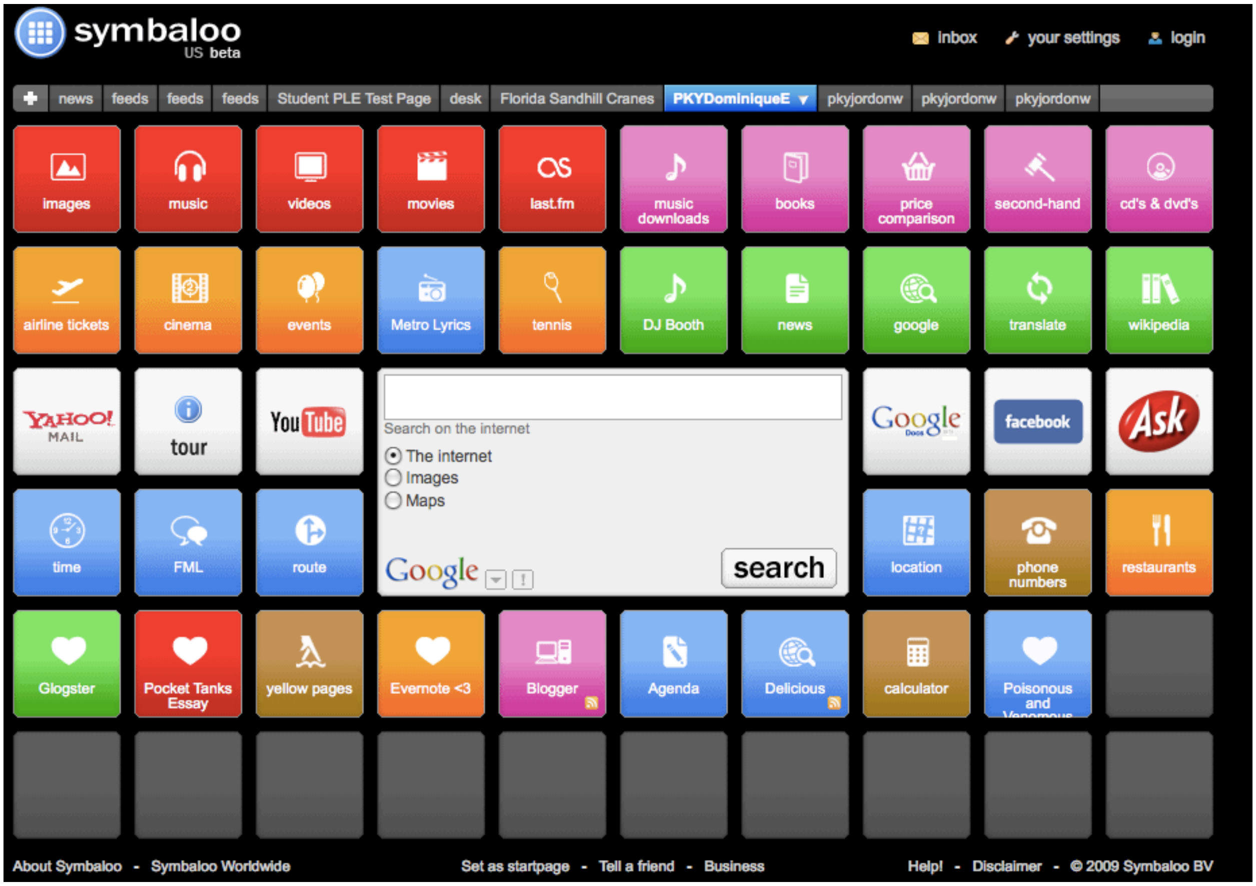


Figure 4-1. Example of Symbaloo personal learning environment created during project

Hundreds of organizational widgets were available on the Symbaloo personal page, not all educational, but many useful for organizing music, accessing news, or conducting searches. In addition to preprogrammed widgets, students created blocks for URL bookmarks and RSS feeds to educational content. Students were directed to organize their pages such that school-related items were clustered together for easier accessibility. The student who created the example in figure 4.1 chose to put her personal widgets across the top of the page. The bottom row included those blocks related to school. The Glogster block linked to a digital poster about the box jellyfish.

This was the poisonous or venomous life form she chose to research for the project. The Pocket Tanks essay block linked to a scientific report recorded in a Google Document to reflect the results of playing Pocket Tanks with her shoulder partner. The teacher designed this activity to teach students the process of conducting and writing a scientific report. The fourth block on the bottom row linked to EverNote, an online note-taking application through which students took clippings from researched Websites and placed in an online folder for future use. A URL link to the original site is provided on every clip to encourage proper citation of content. The Blogger block linked to the student's personal blog on which interesting information was posted about her research as well as class reflections. The Agenda block linked to the teacher's daily agenda from which students received guidance on what to work on during each class. The Delicious block linked to a social bookmarking site where students stored URLs found during the research process and shared with others searching for similar content.

Instructional flexibility was critical to the design process. Not only was the networked learning model new to the students, a new teaching strategy was implemented by the classroom teacher. In addition to new teaching and learning strategies, all project participants were required to learn and master the implementation of emerging technologies. The project required an instructional design that could support the student construction and design of effective personal learning environments. Both the instructional and student designs were important to the success of the project. A detailed view of the processes students went through when constructing personal learning environments is warranted before implications for future design can be fully determined.

Student Processes in the Construction of Personal Learning Environments

There was no typical day in the classroom per se, but patterns in student behavior along with the teacher's approach to the daily agenda (Appendix D) provided a level of consistency to the daily schedule. Students often arrived early to class. The room was situated in tables with four students to a table to encourage student interaction. Mr. H had a rule that non-educational socializing take place in the hall outside prior to class. Students were free to socialize with friends right up until the bell at which time they entered the room, turned on the laptop, and logged on to begin working. Students who chose to come in early were able to get a head start and talk to classmates on topics related to their work. Some students enjoyed playing online games such as Pocket Tanks that had been introduced in previous lessons.

The first ten minutes after the final bell were reserved for students to take care of personal and class-related business. This might include answering email, working on prior assignments, conducting more research, or working on the digital poster. By the end of the first ten minutes, each student was expected to have read the online agenda and commenced working on the first task. Often, there was a short video to watch to set the stage for a class discussion. Depending upon the agenda for the day, the next 20-minute block of time was devoted to independent work or a class discussion focused on introducing a new topic.

Brain breaks were an important part of the block schedule. Silent Speed Monkey was one example of a brain break in which all students stood up and passed a beanbag around the room with various rules for remaining in the game. The last person standing won. The idea was to get the kids up and moving around. Many of the students would immediately return to work upon being called out.

The remainder of the block schedule was devoted to different activities depending upon the progress of the individual students. Some days were organizational days in which the students had scheduled time to organize their personal learning environments. Other days were devoted to peer-reviewed assessments in which students partnered with a classmate to make sure they were making progress on independent research. Mr. H would provide a checklist for the students to assess each other. Regardless of the focus for the day, students were always encouraged to support one another, answer classmates' questions, and share their work. There was usually an air of low banter going on during work times. This was encouraged as long as the noise level was such that independent workers could concentrate.

Additional class time activities included video conferences with scientists, teacher- student and student-student conferencing, small group debates, and independent research. A number of instances were observed in which a student had a question about a topic for which they couldn't find an answer online or for which there was conflicting information. In these cases, Mr. H would often take out his cell phone and call a scientist friend to help find an answer.

Whole class observations were conducted during the initial two-week preparation phase of the study. Two students were selected for in-depth observation over the remaining seven weeks of the project. The classroom teacher identified one of the students as having above average reading scores on the Florida Comprehensive Achievement Test (FCAT). The other was selected based on below average FCAT reading scores. Both students were interviewed separately at the conclusion of the 9-week project. See Appendix B for the list of interview questions.

The following process themes emerged from coding class observations, individual observations, and interviews.

Practicing digital literacy
Practicing digital responsibility
Organizing content
Dealing with technology
Collaborating and socializing
Synthesizing and creating
Taking responsibility and control for learning

Identification of process themes were useful for informing future networked learning design iterations. In such a complex project it is difficult to separate processes evolving as a result of instruction from those emerging naturally while learning. Relevant examples from the study reinforce decisions made during the design process and offer insight into student reactions that result from the design. Discussion of each theme follows.

Practicing Digital Literacy

Students participating in this study had no prior experience with networked learning. They were able to conduct a simple Google search, but did not know about alternative search engines, how to dissect a URL, or how to evaluate the reliability of Websites. They initially limited their search to the first page results without digging deeper or taking time to consider the credibility of the source. Most were familiar with social networking sites such as Facebook, but few had considered applying technology as a means for learning. Consequently, a significant amount of time was allotted to practicing digital literacy.

Student lack of digital literacy was evident in some of the responses to the Northwest Pacific Tree Octopus site. The realistic site pleads the cause of the fictitious animal and its plight as an “endangered species” (Zapato, 1998). Educators often use the site to point out to students the need to critically analyze Internet content. For this project, the teacher presented the site as a mini research assignment and challenged the students to prove or disprove the tree octopus' existence.

> **Student:** Regarding the Northwest Pacific Tree Octopus, "are they real?"
> **Teacher:** "What do you think? After all, it's on the Internet. It must be real, right? "
> **Student:** "I have ten facts collected."
> **Teacher:** "Facts are good. How about questions?"
> **Student:** "I would like to see a real one for proof."
> (Classroom observation, August 27. 2009)

With that, a few students conducted image searches and found numerous pictures of Northwest Pacific Tree Octopuses. Some even found videos, emphasizing the difficulty in evaluating the validity of content on the Internet, especially when others embrace the content as true and build upon the fantasy. One student stumbled upon a discussion board of Internet hoaxes asserting the animal was a fake. She was not sure what she had found; eventually deciding that anyone on the Internet could say something was fake or real.

The teacher initiated a hot seat debate.

> **Teacher:** "This is the hot seat. I'm going to call someone up to the hot seat and they're going to say their argument. In hot seat you sit down and defend your argument in front of fellow scientists. We hope that through the arguing and debating, we can figure out what seems to be true."
>
> **Hot Seat Student:** "We know that pictures exist. We saw pictures."
>
> Student in audience: "The fake pictures were just some guy that wanted to fake it to make people think it's not real."
>
> **Hot Seat Student:** "There are pictures that aren't real. But that doesn't mean the animal is not real. There are a lot of people saying it's not real. But, they are not Tree Octopus experts."
>
> **Another student in audience:** "I really don't think they're real because they have a lot of dumb statements."

Teacher: "You have to back that up with evidence young man."

Student: "How do you know a little kid didn't say mom I'm going to take a picture of a tree octopus with my stuffed animal? Anyone can pretend to take a picture of a tree octopus."

Teacher: "New hot seat scientist. State your claim and call on people with their hand up."

Hot Seat Student: "Somewhere, somehow people got the octopus tree confused with a tree octopus. I think the only way to settle this is to go on an adventure to find one."

Teacher: Going out to find one is something scientists might do. It's not something we can do. If you go out with your parents to Washington, I will call it an excused absence."

Student in audience: I think it's real because I don't think people would be that bored to write a whole site about it to make people think it's real. They wouldn't do that."

Teacher: "You said I don't think. That's your opinion. How do you know?" "There's a lot of what I would consider respectable people that were on the Websites with pictures and stuff. How do you know the people have the right credentials? The site says, I'm a canopy researcher based in Tasmania, Australia and came to your website and was very excited. The picture he has clearly looks real. Seeing isn't always believing. Nobody's ever seen the giant snakes that live in the rainforest, but you believe they're real. You're doing a good job of explaining yourself and that's science."

Student: If they are so real and endangered, why haven't you heard anything about it on the news?

Another student: "But, if people want people to believe it's fake, they could just post things to make it look fake even though it's real."

Teacher: "Do you feel the passion? It's called science, people!" (Classroom observation, August 27, 2009)

The teacher also spent time teaching students how to dissect a URL. He continually challenged the students, "how do you know that when you search for something, you're getting real scientific information and facts?" Student search habits were fairly consistent, even after the digital literacy lessons. Most students began with a Google image search. They were clearly interested in images over text. When text searches were conducted, they began with Wikipedia, next moving to recognizable sites such as National Geographic or those ending in .edu. Still, students predominantly stayed with information found in the first page results of the Google search. Once they found the text they wanted and captured it with EverNote, they used that content to search for more images or video. Video searches were conducted primarily in YouTube.

Students initially took notes by retyping the content exactly as presented on the resource. Once they figured out how to better navigate and capture content, they either collected notes by clipping in EverNote or by copying and pasting. Copying and pasting was especially applied in traditional assignments such as vocabulary and report writing. Students were not aware of the need to cite sources or how to do so properly. The teacher reflected on digital literacy in his classroom.

> One problem is finding scientifically correct content. The other is that they find content that is scientifically accurate and they interpret it incorrectly. You know they look and then finally somehow they just don't choose the right information. This is going to big a challenge for me as a teacher. If a student is interested in the boxed jellyfish and we are talking about venomous and poisonous creatures, not putting down what kind of venom they have is a really big mistake because that is really one of the biggies. They miss the fact that people are afraid of those things in the Australian waters or they don't identify where they are found. That's killing me so I am really going to have to work on how to teach asking essential questions. I think ill be working on that for a year (Mr. H, personal interview, October 30, 2009).

Practicing Digital Responsibility

Digital responsibility is a subset of digital citizenship (Ribble, 2004). It refers to appropriate use of all types of media, behaving responsibly when interacting with others online, and following school acceptable use policies (Ribble, 2004). The teacher was mindful of the need to actively teach these skills throughout the design and delivery phase of this project. The students had little instruction, if any, in appropriate online behavior. While there was a school acceptable use policy in place, few students were aware of its contents. The teacher was very open with the students and continually reminded them of the responsibility that comes with freedom of access to Internet sites. He freely relayed examples of inappropriate use of technology along with his expectations. Reading of comments on YouTube was off limits. Downloading of music was limited to those tunes in which the students already had purchased. They could listen to iPods, but not download music from school. Students were reminded to cite sources properly and give credit to authors. There was only one major infraction during the course of the 9-week project and the students were readily made aware of the consequences. The teacher took that opportunity as a teachable moment. He also relayed an important consideration when developing consequences for misbehavior. Taking access away from students can impact their learning.

> YouTube is the least safe place we have access to. We had our first inappropriate situation yesterday in 6th period. A student went to YouTube and searched for “porns”. I had LanSchool up and could see that everyone else was on NoteFish. I looked at his screen, blanked it out, called him up, printed out screen and sent him to the office. The system worked in the classroom. However, the student code of conduct specifies that he lose computer privileges. That is a problem because he needs the computer to learn. We’re talking about what to do as an alternative. In the meantime, he will work with the Life Science textbook (Mr. H, personal conversation, October 6, 2009).

One outside incident of inappropriate behavior took place when an unknown user joined a class chat session in Twiddla, an online group discussion application that does not require an id or password to use. A few students began communicating with this user giving the teacher another opportunity to discuss Internet safety.

> It could be someone who doesn't know what they're doing. But, it could be someone dangerous. Middle school students are the bravest. High school students have already had problems and learned from them. They tend to be very aware. We thought that was funny and decided to talk back to this unknown stranger and now we may have put ourselves in an unsafe situation (Classroom observation, October 1, 2009).

The unknown user appeared again when the students logged out and logged back in. The teacher made the decision to abandon the activity in the interest of student safety.

Two less severe instances of inappropriate use of technology took place on separate occasions. Both were related to accessing sites that were approved for the classroom, but accessed during a time when students should have been working on other assignments. In one instance, the student opened a chat session and invited those sitting around her to participate. In the other, the student went to his Napster account to download music to listen to on his iPod. The iPods are approved, but should have been pre-loaded with music.

Students seemed to take the responsibility placed upon them for this project quite seriously. There were sites they accessed from home that were identified by the teacher as inappropriate for school. Over half the class responded that they had Facebook or MySpace accounts before turning 13. They admitted to lying about their age to gain access to the sites they want to use for social networking. They would make comments about sites that they knew were inappropriate for school to see if the teacher was aware. "Can I look that up on Urban Dictionary? I was on Urban Dictionary all night last night." One student explained the rationale for following teacher instructions at school.

> No, like I've never been, I never went on Facebook. I mean when we first got it I saw the Facebook button was there [on Symbaloo] and we all clicked on it, and it went. But then we logged right back off. We didn't go on it, and I haven't been on it. I knew that that's not what we're supposed to do and

> that they could see what we were doing. If we did that, our Internet might get blocked again. He [the teacher] told us we have a lot of freedom, but he told us that if we mess it up, we might not have the freedom anymore. Even though we didn't use it, it's just nice to know you have it. If it would have been taken away, people would have tried to go on the websites anyway and figure it out. You don't really come in contact with inappropriate content because you're usually on websites that you're supposed to be on. If it does happen then we know what to do automatically. You're not tempted to do anything. You automatically exit out of it (Student A, personal interview, October 29, 2009).

Ultimately, the students practiced the digital responsibility that was conveyed verbally and reinforced by the classroom teacher.

Organizing Content

Organization is a key process in the construction of personal learning environments (Johnson, 2008). Students had to set up user accounts, add content widgets on Symbaloo personal pages, and rearrange the widgets to meet their needs. In order to synthesize the content accumulated during the research process, it was important to have organized it in such a way as to maximize ease of retrieval. Organization of the Symbaloo pages differed from one student to another. Some had only a few blocks on the personal page representing only those resources to be used in school. Some had as many blocks as could fit on the page with everything from the

Figure 4-2. Comparison of organization of student Symbaloo pages.

required school widgets to CNN News or Priceline.com. Each student had complete control over the way the content was organized. Some arranged by color. Others organized blocks by function. Figure 4.2 provides two examples for comparison. The teacher commented on the organizational style of one particular student.

> One student put everything he wanted that was school related around the white box and filled the page with other blocks. Some he wasn't even going to use. But he really wanted to do it that way. It wasn't an accident. He purposely wanted to see how many sites he could put on a single page. That has nothing to do with learning in science. But, that creative working part about that student's brain was used in school, and it made it really fun for him. I don't know how that contributes to his motivation, but it has to be a good thing to use those parts of your brain that traditionally we turned off or told them it wasn't appropriate. This is the same kid whose backpack is exploding with paper, but thank goodness none of it is from my class (Mr. H, personal interview, October 30, 2009).

The teacher fully respected each student's organizational style and preference, empowering the learner to make decisions about the learning process. In some cases, he offered suggestions for structural layout. In others, the Web application in use provided the organizational structure.

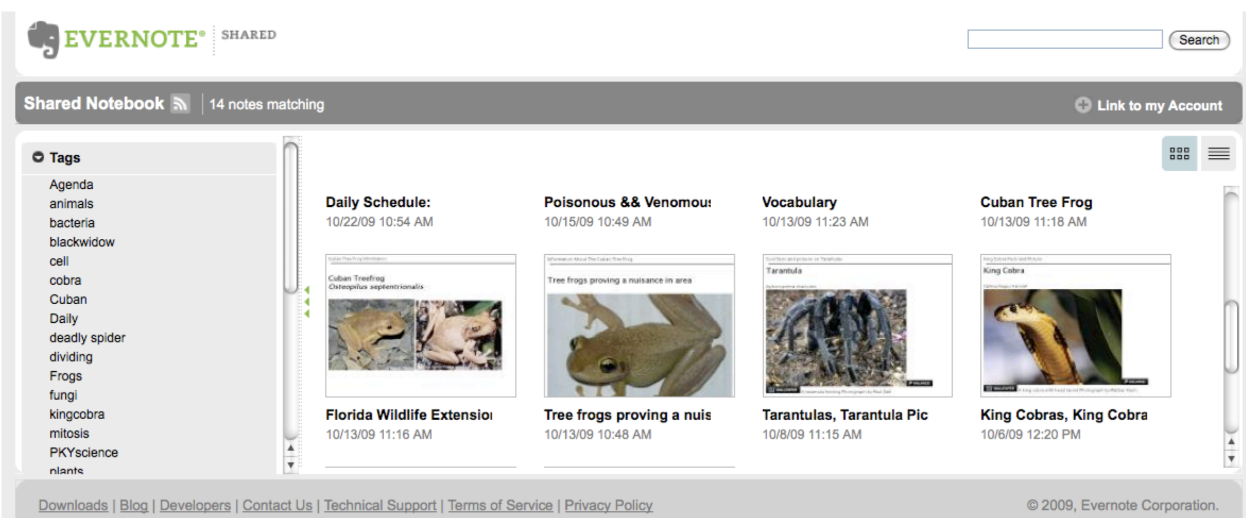


Figure 4-3. Example of EverNote organization of content resources.

The note taking tools, NoteFish and EverNote, organized student content by date of retrieval. The sites also provided an image and URL from the original source. Students could easily scan the page of Web clippings to find the content they needed.

Organization skills were also exercised in the synthesis of content for scientific reporting. In the case of the Pocket Tanks report, the teacher provided the top-level headings: state the problem, gathering information, hypothesis, experiment, recorded data, and conclusion. The Pocket Tanks report served as an example for future scientific reporting.

A Glogster digital poster posed another organizational challenge for the project. Students synthesized content from notes and sites they had bookmarked during the research process. The Glog incorporated a background wall, text, audio, images, and video. Students determined all content and layout. This process was observed in detail. The following observation documents a student's organizational activity while constructing the Glogster digital poster. The observation captures 15 minutes of the construction process. This multitasking behavior during the construction process was typical of the two students who were observed in detail.

1. Adding text about Death Stalker Scorpions.
2. Working on wall.
3. Continues to experiment with different walls.
4. Back to information about Death Stalker Scorpions
5. Clicking through first few Google returns on "death stalker scorpions" (searching for more content after research is presumably complete)
6. Copying and pasting content from site
7. Helped another student import video

8. Importing image. Image didn't work. Back to wall.

9. Adding more text.

Both of the observed students showed concern for layout design, placement, and inclusion of content. In one example, the student was focused on the laptop as he worked through these steps and seemed somewhat agitated when another student asked for assistance. He did break away from his work to help the other student, but quickly returned to his seat to continue working on his own creation.

Figure 4-4. Example of student Glogster digital poster

Each student observed in the class during the Glogster project was focused on his or her work in a similar fashion. There was a collective class sigh when the teacher prompted the students to move on to another activity. They were clearly engaged in the Glogster project and eager to continue this activity.

Many aspects of the instructional design of this project offered the students organizational flexibility. Students clearly enjoyed the added control. Furthermore, the teacher made a concerted effort to balance the structure such that students had the optimal control without experiencing high levels of frustration. In those cases where students expressed frustration (usually centered around technical issues), he was available to offer guidance.

Dealing with Technology

Dealing with technology issues was expected due to the technical complexity of the project. The researcher and classroom teacher anticipated and addressed some technical difficulties during the instructional design phase of the study. The school was not operating a laptop program. Approval had to be obtained for all seventh grade science students to have one-to-one access to laptops during the course of the research. The project was not aiming to integrate one technology into an existing curriculum, but to combine the integration of many emerging Web applications to create a new curriculum. Just the complexity of the technology integration was enough to cause concern. Ultimately, the actual issues with technology fell into three categories: students distracted by technology, problems related to the Web applications used in the project, and systemic issues (those problems resulting from the network administration policies and/or procedures). As it turned out, most issues were related to the latter. It was the school administrative policies or lack thereof that had the greatest negative impact on the project.

Distractions caused by student use of technology were minimal. Those that were evident merely resulted in brief time off task, usually less than a minute or two. Students were intrigued with each new application and how it worked. They wanted to experience every small detail whether or not it was related to learning. “How come the computer doesn’t make sad faces. I don’t want a smiley.” Students were often intrigued by the work of classmates, especially when someone stumbled upon something of particular interest. In most cases, this was a positive aspect of the learning process giving students the opportunity to collaborate on content directly related to the lesson.

On the other hand, students expressed frustration when technology did not work as expected. “I’m saving every two seconds. I don’t want to lose anything. But, it’s so slow.” One student recounted during the interview.

> Sometimes it’s frustrating when things stop working and we get a lot of work at the same time. So, if like, your computer stops working or something like that, then it, it’s frustrating because you get really behind. Like if you’re in the middle of work, the computer could turn off (Student A, personal interview, October 29, 2009).

Distractions caused by technical issues with the Web applications were also minimal. At first, students had a hard time managing passwords. They needed some time to get used to working with the computers and applications that didn’t reside on the computer hard drive. One student tried to save his EverNote notes on the computer. This did not work because the applications were running in the cloud, or on the Internet. Students adapted to the learning environment very quickly, however. Once they had a few minutes practice within any given application, they picked up the procedure very quickly.

There were only three technical issues related to the applications selected for the study. In each case, work-arounds were easily implemented to minimize interruptions in the learning process. One day, Symbaloo went off line for application upgrades. The teacher simply sent the students directly to the daily agenda bypassing the need to access Symbaloo for the day. On another occasion, a browser update was posted for FireFox. Unfortunately, NoteFish (the first note taking program used by the students) was not supported in the upgrade. EverNote was selected as an alternative note taking program. Some class time was taken to set up student accounts for the new application. The third instance was more of a nuisance, especially to students who did not follow directions to save often. The Glogster digital poster program did not automatically save while students were working on their projects. Consequently, some work was lost when the program froze. Luckily, the design process in Glogster is very easy, so it did not take a lot of time for those students to re-create what they had lost.

Systemic issues were by far the greatest challenge to the success of the project. The network administrator, focused on protecting the network and ensuring students did not access inappropriate content was skeptical about opening sites and providing liberal access. At the same time, the classroom teacher sought open access to all applications needed for the study. The network administrator took a very conservative approach to network accessibility. All computers required student logins and passwords. Deep Freeze, work station software used to protect against accidental or malicious damage, was installed on the computers making it impossible to download any content or applications from the Internet without the intervention of the network administrator. Computers were set to shut down and restart after 15 minutes if not used in that timeframe. New students waited up to two weeks for logins and passwords. There was no official process in place to open blocked sites needed for educational purposes. The teacher often waited for days for those sites to be unblocked. In the event he was unable to use a new site, he would adjust the lesson plan to accommodate.

LanSchool, a student laptop-monitoring program, was installed on the teacher and student computers to allow visibility to every laptop screen from the teacher's workstation. This was a very easy way for the teacher to monitor student online behavior. Unfortunately, a feature of Deep Freeze used to protect against unauthorized downloads, removed the program every time a computer shut down and restarted. A significant amount of class time was lost reinstalling the LanSchool application each time it was lost. Finally, the network administrator came into the class and reset the computers so the LanSchool application could be permanently installed. This process took an additional 45 minutes of class time in the period in which the installation took place.

In spite of the frustrations stemming from the systemic technical issues, students had positive reflections about dealing with technology.

> The technology we're using is more advanced but it's easy. It's easy to use, um, like, most of the time I like using the computers and we use them for all of our projects and I like it a lot better because it's easier to keep up with and like um, you don't really need any materials or whatever. You can store everything online. I like Evernote and I think I'll use it in the future for projects because it's easy to hold information and stuff. You can type on and copy stuff from a Website and then type on your work and make notes and stuff. I liked Blogger better than Glogster even though you can do more stuff with it. I just liked Blogger because it was easier to use and I think that if I ever had a personal blog, I'd probably use Blogger for it. Symbaloo is

> useful because you already have all your Websites on it to make it easier just to access them (Student A, personal interview, October 29, 2009).

The teacher felt that the positive aspects of dealing with technology had a positive influence on the quality of work.

> I have papers from my lower students that would blow away my top students from last year in terms of how well thought out the conclusion is. One of the reasons I think that is starting to happen because of the social aspect of technology and the fact that everyone is posting their work online. First of all, your putting yourself on the spot and second of all, everyone can go see student A's slideshow because I put it on the agenda. The sharing aspect is so huge. That alone has caused everyone to step up their game a little bit. You put a couple examples on the agenda and other students try to top them. I would say that the students learned faster with networked learning. I feel this is a really good way for students to learn (Mr. H, personal interview, October 30, 2009).

Dealing with technology was a key process for the teacher and students. While some issues were foreseeable and could be addressed before the project began, there were many other issues that arose randomly throughout the study. Addressing them effectively required creativity and flexibility. When the classroom teacher relayed some the technical issues to colleagues in his department, they all agreed that such frustration would preclude them from trying anything similar in their own classrooms. The teacher surmised that his colleagues' frustration with technology in the past coupled with the pressure to cover ever-increasing quantities of content contributed to their reserve. He hoped that mentoring, a review of the school's network management, and the recognition that many educational standards can be covered via networked learning might lead to increased technology integration in the near future.

Collaborating and Socializing

Socializing and collaborating took a number of forms including whole-class, conversing with another student, helping another student, and questioning or conversing with the teacher. Students had greater difficulty resuming on-task behavior when whole-class socializing was taking place. However, most examples of this were directly related to instruction.

When the class was starting to learn about poisonous and venomous animals, they were prompted to find the scariest animal alive. This search turned up some pretty interesting specimens the students were very anxious to share. So, while there seemed to be a lot of noise and general confusion, listening closely to student conversations revealed excitement about the topic and behavior related to the lesson. One student found a video called “My Pet” of a particularly curious breed of dog. Everyone gathered around to see it and many asked, “could that be real?” This prompted further discussion about digital literacy and what could be done as scientists to determine if the animal was in fact real.

Students were encouraged to talk to classmates and work with partners, especially when using new applications. The teacher often provided a checklist for the students to ensure that partners were caught up and fully understanding the task at hand. Typically, student A would start with the first item on the checklist. Student B would check it approving or disapproving. The two would switch until they made it though the list. If there was an incomplete task or if the partner had a question, the pair would clear it up in the process.

Students were comfortable asking classmates and the teacher for help and offering assistance. The teacher would sometimes facilitate this behavior by directing student A to explain a concept to student B or vice versa. This forced the students to articulate their understanding while reinforcing the learning of the partner. Statements overheard during this process included “come here, I need some help”. “How do I get rid of all that extra box space?” “How do I click below it to write something?” “What do you do for the conclusion?” “How do I get certified to hold Zoey?” Most of the questions were procedural. Students quickly figured out they did not have to ask content questions with all the information on the Internet at their fingertips. When they forgot, the teacher reminded them.

> **Student:** What is a plume?
>
> **Teacher:** Hmm, I don’t know. Where could you go to find out?
>
> **Another student:** Just do a search with def: .
>
> **Student:** Oh, a plume is a feather.
> (Classroom observation, August 27, 2009)

The teacher was very comfortable with students talking and wandering around the room. He did not view classroom control as students sitting neatly in rows working quietly. He saw socializing as an important part of the learning process, both between students and with experts outside of the class.

Synthesizing and Creating

One of the main educational objectives of the project was for students to model the scientific process. Synthesizing research content and creating an artifact from which others can learn was part of the instructional design. The teacher tried to provide opportunities for the student to experience scientific thinking. One student reflected on what it means to think like a scientist.

> Think like a scientist means to think about things instead of just looking at them from the outside. Think about why they are that way. Think about how they got that way. Think about, like, where they came from. Question your ideas. Test them, things like that (Student A, personal interview, October 29, 2009).

In order to create an artifact that represented the scientific process experienced by the student, he or she had to research a poisonous or venomous creature and synthesize that research in a manner that was understandable by others. One student explained with excitement what he had learned about the death stalker scorpion.

> It's that it's a medium-size scorpion, and it can, if you start to mess with it, it will fight. It will, like, follow you and then attack you, going with the name. And, it has weak pinchers, but it has an extremely strong venom that it will inject into you and then it would paralyze you, put you in a coma, maybe even kill you (Student B, personal interview, October 29, 2009).

The student's description offered details about the way the death stalker scorpion fights, how it got its name, and specifically how the venom works. This was the result of extensive research on a self-selected topic for which this student had great interest.

Students were also asked to reflect on how scientists might apply some of the tools they had used to conduct their research. One student thought that blogging was a good way for scientists to publish their research to share what they've learned with the world.

> Like, say like if you are a famous scientist, you would post every -- all the information that you know. Then, you would show it to everybody so that everybody then will see what you've done and learn about something (Student B, personal interview, October 29, 2009).

The artifacts students created to represent the synthesis of their research included a scientific report and a Glogster digital poster. The students used the Internet to identify subject matter experts, scientists who specialized in the animal researched. They emailed the scientist and provided a link to the digital poster asking for feedback on their work. Those students who received feedback experienced the peer-review process first hand. Scientists who responded were eager to provide feedback, including guidance about proper citation. Here is an excerpt from one respondent.

> A few comments:
>
> You might want to look at my article on blue-rings. It can be found at: http://www.thecephalopodpage.org/bluering1.php
>
> There are four described species of Hapalochlaena and probably half a dozen more that have not yet been formally described.   We don't know if they are all venomous.
>
> The plural of octopus is octopuses.
>
> Watch your use of venom, toxin, and poison.   Poison is not correct. TTX is a toxin, but because it is delivered by a specific evolved mechanism, it should in the case of blue-rings be called a venom.
>
> You are not "infected" by a bite from a blue-ring (unless you survive and develop a secondary bacterial infection.) It is probably better to just say that you are bitten by a blue-ring.
>
> There is considerable controversy whether there is more than one toxin in blue-rings. The best evidence we have suggest that there is just tetrodotoxin (you spelled it incorrectly).
>
> Respiratory assistance is usually needed for only a few hours.   I have not seen any medical records that required ventilation for more than several hours.
>
> Two of the photographs of H. lunulata that you posted were taken by me. Internet courtesy suggests that you should ask permission to post them. (Mr. H, personal email, December 3, 2009)

This example is representative of those received by other scientists. Students received feedback that could improve their artifact while increasing the credibility of the information presented therein. It also put the responsibility for providing accurate information squarely on the student. Proper citation of sources was a recurring theme in daily lessons. Students did not realize or believe there could be real consequences to copying content from the Internet until experts reviewed their work. Mr. H gave students the opportunity to revise the presentations to earn a better grade by citing properly and acknowledging the contributions of outside experts. Students were continually reminded that ease of copying did not excuse them from the responsibility to give credit where credit was due.

Taking responsibility and Control for Learning

Processes related to taking responsibility for learning included distraction by others, distracting others, engaging in assigned tasks, and self-regulating. Processes related to control included multitasking, taking different approaches, working outside of class, perceiving the workload and perceiving the level of control.

There are distractions in any learning environment. The science classroom in which this study took place is filled with class pets including a chameleon named Sarah and a bearded dragon named Zoey. There is a tarantula and tank full of axolotls. Students research these animals to get certified to hold them in class or care for them at home. Nearly every distraction recorded during this project was related to students eager to have a turn holding or observing the class pets. In only one case was the distraction related to technology. One student opened a chat session on Twiddla and invited other students at the table to join in. The process of trying to distract others was in line with typical middle school behavior such as drumming with a ruler, tapping on the table, or talking to other students about unrelated topics. This behavior was rare, as most students had plenty of work to keep them engaged.

Students were engaged in assigned tasks most of the time. The whole class environment was set up as an experiment, and the teacher relayed that position to the students. When tools did not work, they figured out together how to make them work. For example, in one situation the teacher opened a chat to brainstorm ideas for using Twiddla effectively in the classroom. Every single student in the class was engaged in the chat and each offered at least one idea. The teacher offered his thoughts about time on task during the project.

> Time on task really surprised me. I have had very few actual issues with that. I have students who get unfocused, but the time on task is off the charts compared to what it normally is. I don't think you are ever going to have 100 percent everyday or 100 percent all the time. I'm not sure that exists (Mr. H, personal interview, October 30, 2009).

Self-regulating behavior was evident after the first two weeks of school. During that preparation time, students were learning the tools, class procedures, and expectations. Once the teacher established the routine, students came into class and began work immediately on the agenda. If a student was socializing inappropriately prior to the bell signaling the start of class, the teacher asked him or her to go out in the hall to talk. He also gave students the option of taking the first ten minutes of class to answer email or take care of personal business. He was trying to set up a work environment similar to that experienced in the professional world of work where employees determine when and what to work on for the day. Some students were so involved in their research that they continued working during breaks.

The ways students took control of the learning process varied between the high achieving and struggling student in the study. The high achieving student was a masterful multitasker. She would do a few items on the agenda, go help another student, answer email, write part of a report, hold a class pet, return to the agenda, give the class pet to a classmate, talk to her table partner, and finish up the agenda. The struggling student was extremely focused on the task at hand. He would go through the items on the agenda one by one seemingly oblivious to those around him. About six weeks into the project, this behavior changed. Before the bell, he was helping another student with the Pocket Tanks game. He leaned back over to his computer to view the agenda and returned to help his classmate as it loaded. He continued to work back and forth between the agenda and the game. It was interesting in that he had become comfortable enough with the process to juggle the two tasks effectively.

The student identified by the teacher as a struggler also took control of the learning process by finishing a second Glogster at home. He was excited by the tool and enjoyed working on the digital poster. He didn't worry about falling behind during class because he knew he could catch up at home, something he typically did not want to consider. He did not perceive the workload as particularly heavy. He was used to leaving work unfinished during class time. The high achiever, on the other hand, had a different perception of workload.

> I do like to have a lot of things at one time but sometimes it's too much. Everyday we come in and it's something different and its not that I have a one track mind set. It's like almost OCD to where everything has to be done at once. I'm a bit of a perfectionist. Everything has to be done before I can move on to the next thing or I start to worry and like everything starts to pile up and I get really stressed because I know I have so many responsibilities (Student A, personal interview, October 29, 2009).

Interestingly, her reflection did not match her actual behavior. She was able to do a lot of things at one time, but she did not finish one task and move on to the next. Rather, she did many tasks a little bit at a time. The teacher surmised that she had always been able to complete work early with time left over to do other things. With networked learning, there was no such thing as being finished. She was having a hard time coping with that.

Even so, she perceived that she had increased control over the learning process.

> I feel more in control in this class because it's not that I can choose not to do something, it's just that I can choose how to do it and when to do it. You know there is a deadline but because he gives us so much freedom, you

> choose to do it anyway. Like if he told us that you had to do it by this time, most people probably wouldn't do it. Well for me it helps because I'm the kind of person who like, if you give me a lot of things at one time I get them done. That's just the way my mind works. It's like a checklist, so having freedom on when to do things helps because then I can get them all done in the order I want and stuff (Student A, personal interview, October 29, 2009).

The teacher's perception of control and the learning environment was as follows.

> It is really bizarre. The student characteristics necessary for networked learning, I don't know, maybe they have to be young. They like this kind of learning. It makes a lot of sense to them. The student characteristics conducive to network learning are the same as student characteristics for being successful in school to a degree. The students who are having the hardest time with network learning are the ones who are real scattered about organizing things like past work and you know, technical issues. Students who are not comfortable solving technical problems on their own have a hard time. Some have me solve them for them. That's fine and some solve for themselves. Others are not sure what to do and if they don't find me soon enough, it becomes the biggest set back. I had one guy in first period who out of the 100 minutes probably worked for 10 or 15 because of the technical issues and then it was killing me and it was killing him and that was a really hard day. When it's working, it makes the teacher's life easier and it make the student's learning higher (Mr. H, personal interview, October 30, 2009).

Constructing Knowledge

The Constructivist Learning Environment Survey (CLES) measured student perceptions of the classroom learning environment within five scales: personal relevance, uncertainly, critical voice, shared control, and student negotiation. It consisted of 25 questions with 5 questions in each of the 5 scales. The survey was administered to 96 seventh grade science students in 5 classes within the first week of school to document their perceptions prior to engaging in the networked learning project. It was administered again at the end of the project. Results were compared to determine whether student perceptions of the constructivist environment changed as a result of participation.

The Constructivist Learning Environment Survey (CLES), developed by Peter Taylor and Barry Fraser, "monitors the development of constructivist approaches to teaching science and mathematics" (Taylor et al., 1997, p. 295). Five scales were measured:

- Personal Relevance Scale - connectedness of school science to students' out-of-school experiences, and with making use of students' everyday experiences as a meaningful context for the development.
- Uncertainty Scale – extent to which opportunities are provided for students to experience scientific knowledge as arising from theory-dependent inquiry involving human experience and values, and as evolving, non-foundational, and culturally and socially determined.
- Critical Voice Scale – extent to which a social climate has been established in which students feel that it is legitimate and beneficial to questions the teacher's pedagogical plans and methods, and to express concerns about any impediments to their learning.
- Shared Control Scale – concerned with students being invited to share with the teacher control of the learning environment, including the articulation of learning goals, the design and management of learning activities, and the determination and application of assessment criteria.
- Student Negotiation Scale – extent to which opportunities exist for students to explain and justify to other students their newly developing ideas, to listen attentively and reflect on the viability of other students' ideas, and, subsequently, to reflect self-critically on the viability of their own ideas.

(Taylor et al., 1997, p. 296).

A copy of the Constructivist Learning Environment Survey is provided in Appendix E.

Based on the post-survey descriptive statistics, students scored highest in the scales of personal relevance, uncertainty, and student negotiation. They felt they could connect science to their everyday experiences between "sometimes" and "often". They believed opportunities were provided to experience scientific knowledge from theoretical inquiry, and they were comfortable sharing the viability of their scientific ideas with fellow classmates (Taylor et al., 1997).

Table 4-2. Average item mean and standard deviation for CLES Scales

Scale	No of Items	Unit of Analysis	Average Item Mean	Standard Deviation
Personal Relevance	5	Individual Class	3.94	.69
Uncertainty	5	Individual Class	3.85	.59
Critical Voice	5	Individual Class	3.61	.95
Shared Control	5	Individual Class	2.90	1.15
Student Negotiation	5	Individual Class	3.94	.99

Overall students perceived that their science class reflected constructivist aspects between 'sometimes' and 'often' (Lee & Fraser, 2000). The mean range was 2.9-3.9 (3 corresponds to 'sometimes', 4 to 'often'). The mean scores in personal relevance, uncertainty, and student negotiation were near 4 "which implies that aspects described in these three scales" occur 'often in their science classroom (Lee & Fraser, 2000, p. 7). Critical voice fell between 3 and 4 or more than sometimes, less than often. Whereas, shared control was near 3 or 'sometimes'.

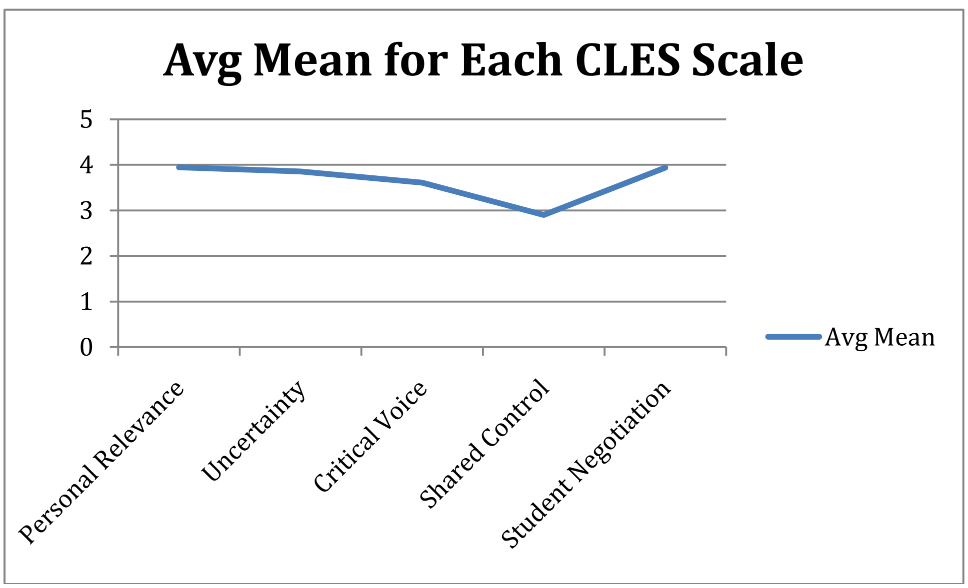


Figure 4-5. Seventh grade science students perception on post CLES survey

In addition to the descriptive statistics collected from the post-CLES survey, a paired samples t test was conducted to compare student responses in the pre-CLES survey (given at the start of the school year based on student perceptions of their sixth grade science class) to the post-CLES survey (based on student perceptions of their seventh grade science class after the networked learning project). The survey was divided into 25 questions, five questions in each category corresponding to five different scales. The first five questions are titled “Learning about the World”. They correspond to the personal relevance scale. Questions 6-10 are titled “Learning about Science”. They correspond to the uncertainty scale. Questions 11-15 are titled “Learning to Speak Out”. They correspond to the critical voice scale. Questions 16-20 are titled “Learning to Learn”. They correspond to the shared control scale. Questions 21-25 are titled “Learning to Communicate”. They correspond to the student negotiation scale.

Table 4-3. Paired samples t test comparing pre-CLES to post-CLES

		Paired differences 95% confidence interval of the difference				
		Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	World - World	-2.519	.592	-1.242	54	.220
Pair 2	Science - Science	-1.394	1.140	-.201	54	.841
Pair 3	Speak out - Speak out	-4.750	-1.287	-3.495	54	.001
Pair 4	Learn - Learn	-4.180	.362	-1.685	54	.098
Pair 5	Commun - Commun	-3.634	-.293	-2.357	54	.022
Pair 6	PRETotal - POSTTotal	-14.232	-1.731	-2.560	54	.013

The means for all scales increased from the pre-CLES survey to the post-CLES survey. However, these increases were only significant with a 95% confidence interval in the critical voice scale (Speak out - .001 significance) and student negotiation scale

(Communicate - .022 significance). Student responses in the post-CLES survey represent a significant increase in perceptions of their ability to question the teacher and to express concerns about any impediments to their learning. Responses further indicate a significant increase in students' perceptions of opportunities to openly express their scientific ideas and views.

One cannot consider the processes students go through when constructing personal learning environments without consideration of the teacher influence on those processes. The teacher in this study was selected for his open mindedness, scientific expertise, and constructivist philosophy. It is possible the CLES survey would have gleaned similar results had the teacher maintained his traditional curricular structure. Results indicate that students do perceive the learning environment as constructivist between 'sometimes' and 'often'. Further analysis of the scales for which there was no significant increase in the mean responses has implications for future design iterations. These implications are discussed in Chapter 5.

Chapter 4 addressed a key step in the design-based research process, the evaluation and testing of the Networked Student design in practice. Findings were reported in two sections. The first, an evaluation of the instructional design, set the stage for better understanding the second, processes students go through when constructing personal learning environments. Chapter 5 explores the implications these processes have on future design iterations.

CHAPTER 5
DOCUMENTATION AND REFLECTION TO PRODUCE DESIGN PRINCIPLES

Chapter 5 reflects on the findings and provides a set of design guidelines for future facilitation of student constructed personal learning environments. Design principles derived from the study were based on instructional challenges, lessons learned, and the processes students went through as a result of participation in the project. Consideration of the factors that influence learning outcomes further informed the principles for future design. These factors included: student readiness to meet the instructional challenges, selecting the appropriate technology, instructional strategies, and support for the learning objectives; and making revisions based on the outcomes of the first iteration design (Morrison et al., 2007). As a result, the Networked Student Model was revised to reflect a stronger focus on processes rather than tools. Teachers who wish to implement a similar networked learning approach are advised to refer to the revised model to inform the instructional design. Chapter 5 is divided into the following sections: Preparation for Networked Learning, Evolution of the Networked Student Model, and Design Principles for the Construction of Personal Learning Environments.

Preparation for Networked Learning

There are a number of critical components in the preparation and planning phase of a networked learning project. These areas should be addressed well in advance of implementing the design with a group of students. The following components represent those considered prior to implementation of the first iteration design in this study.

- Technology (hardware, software, network)
- Administrative support
- Instructional flexibility
- Work-around plans
- Setting expectations with students

The researcher and participating teacher attempted to foresee potential problems. Not surprisingly, unexpected issues and challenges arose during the course of the project. Addressing them early and aggressively could have minimized impact on instructional time and student learning. Lessons learned in the first iteration implementation generated valuable advice for the preparation phase of future designs. The following list represents suggestions based on key findings.

1. Assure one-to-one access to networked computers.
2. Build a solid relationship with the school network administrator.
3. Know the general set up and limitations of the school network.
4. Agree upon a process for dealing with technical issues, blocked sites, and potential threats to the network.
5. Foster and maintain administrative support.
6. Be flexible.
7. Have a work-around plan.
8. Set expectations for all stakeholders.

Assure students have one-to-one access to networked computers over the course of a project. Include a plan for replacing computers that fail. Technology with all its learning potential can also pose the greatest threat without proper planning and support. This study was not conducted in a one-to-one school. Arrangements were made during the summer to provide the class unlimited access to a laptop lab. There were just enough computers for each student in the largest class. Within nine weeks, five computers out of twenty-five were out of operation. Students used desktop computers in neighboring classrooms and the media center as alternatives, but it was logistically difficult to bring the class back together for discussion. It may prove more manageable to conduct future projects in an established one-to-one environment where procedures are in place to quickly repair or replace broken computers. The class in this study experienced a 20% fail rate of the computers they had at the start of the year. Most of these laptops were three to five years old. The administrative team along with the network administrator determined that netbooks provided a less expensive alternative to repairing or purchasing new laptops. The netbooks proved to be an acceptable choice. Since every Web application used in the project was available online, there was no need for replacement of expensive software or the hard drive space to support it.

Build a solid relationship with the school network administrator. His or her support is crucial. This person could very well be the single point of contact for hardware, software, and network issues. Such was the case with this project. Even though the researcher and teacher met with the network administrator numerous times before the project began, there was no set procedure for dealing with daily problems. New students waited up to two weeks for an id and password. Sites with educational potential were blocked by school network filtering programs. Requests to unblock sites took up to 4 days to process. Valuable learning opportunities were lost because a consistent plan for unblocking sites was not put into place. Consequently, the relationship between the teacher and network administrator grew increasingly tense. Such difficulties were not the fault of the teacher or the network administrator. They emerged as a result of miscommunications and differing expectations. Building a partnership between administration, network administration, and the classroom teacher will help alleviate some of the issues experienced in this case study. Such a partnership must be cultivated over time. Acceptable use policies should be addressed and developed by the whole school community, including teachers, students, parents, administrators, and network personnel. Responsible behaviors and expectations must be clearly stated with well-defined consequences on which all parties agree. Still there are broader policies that may have to change before such problems are completely solved. Vaguely written Federal legislation such as the Children's Internet Protection Act (Federal Communications Commission, 2001) do little to provide schools with guidance, especially when there is fear of losing precious funding. However, a community approach to responding to such policies gives strength to the decisions made in the interest of student learning.

Know the general set up and limitations of the school's network. Network designs vary from district to district and between schools within districts. While most schools use some form of network filtering, they also vary in the amount of additional software installed to protect the network. The success of this project was most threatened by systemic decisions made in the interest of protecting the network from unauthorized downloads and student tampering. Deep Freeze™ was installed on each computer causing it to automatically shut down after 15 minutes of non-use. Once the computer shut down, any items downloaded during the most recent session were erased from the hard drive. Students were unable to download inappropriate content from the Internet. Unfortunately, it also kept them from downloading browser add-ons for the Web applications used in their personal learning environments as well as the software the teacher needed to monitor all the computer screens during class time. In order to download the browser add-ons and monitoring software, the network administrator had to come to the classroom, have all students shut down the computers, turn off the Deep Freeze™ program, reboot the computers, install the needed software, shut down the computers, turn Deep Freeze™ back on, and re-start the computers. In the observation class, this process took nearly 40 minutes; valuable teaching and learning time lost. To the network administrator's credit, he had managed to build a very secure network and avoid many common issues related to student misuse of technology in school. Most technology integration up to this point had been software-based or focused on one or two unblocked Websites. Never before had any teacher at this school tried to integrate so many Web-based tools at once to achieve a comprehensive networked learning experience. In attempting to do so, the teacher exposed the challenge that many others will face who try to follow. How does a school balance network security, student safety, and legal liability with the innovation and learning potential the Internet has to offer? A community approach that takes into account the unique needs of its students and their learning goals is a good place to start. Balance can only be achieved through communication with all stakeholders. Teachers and administrators must communicate expectations to students repeatedly and consistently. Students, aware of the consequences, must be held to those expectations. If there is a breech of the acceptable use policy, or if issues arise with home computing, parental support is crucial.

Agree upon a process for dealing with technical issues, blocked sites, and potential threats to the network. Once a relationship is built with the network administrator and the current network infrastructure is understood, the teacher is better equipped to negotiate a reasonable plan for responding to technical issues and unblocking sites. He or she can further discuss how students will be supervised and the responsibilities taken for student behaviors. Network administrators are not necessarily former teachers. They don't always understand that teachers can't plan everything that happens in the classroom. Sometimes spontaneous access to a resource is necessary to support the lesson. The teacher can likewise help the network administrator appreciate the educational value of networked learning and why increased access to the Internet is warranted. This is where administrative support is also critical to the success of such a project.

Foster and maintain administrative support. This research would not have been possible without the encouragement and support of the school principal. She was enthusiastic about the project from the beginning and envisioned the potential for student achievement. She understood the many aspects of networked learning in a K-12 school that overlap administrative responsibilities. As with the network administrator, the principal was concerned about student safety and appropriate behavior. She also ran interference in situations where the teacher and network administrator did not agree. When it comes to technology, some administrators (and teachers) are more knowledgeable than others. But few have highly technical network management expertise. Initially, it is logical to assume that a computer and Internet access are all that is needed to facilitate networked learning. The participants in this study and the researcher did not fully appreciate the complexity of the network environment until the project was well underway. The continued leadership and support of the principal ensured the project continued in a positive direction and the students' best interests were maintained on all fronts.

Be flexible. When every day brings new challenges, flexibility preserves sanity and keeps the project on track. The teacher who participated in this study was selected for his constructivist approach to science education, the relationships he was known to build with students, and his flexibility. Student construction of personal learning environments put increased responsibility for learning on the student. The teacher gave up a certain amount of control in favor of empowering the learner. Maintaining the proper balance was a daily juggle. While the teacher managed to stick with the original unit plan from a content perspective, daily activities were adjusted to support the learning needs of the students and work around technical difficulties. It was impossible to write and stick to a detailed lesson plan in this type of environment. However, planning ahead for possible alternative approaches and differentiated instruction made it easier to deal with unexpected situations.

Have a work-around plan. Technology is notoriously unpredictable. The teacher participating in this study was highly experienced, knew his curriculum, and was comfortable in an unpredictable environment. He also knew that a backup was crucial when the daily plan went awry. He never once reverted to the textbook used previously in the course. He did, however, replace technical difficulties (including a power outage) with hands on experiments, group activities, or outside explorations. These collaborative activities were designed to enhanced the overall learning process.

Set expectations for all stakeholders. Stakeholders include the administration, the network administrator, fellow teachers, parents, and the students. Numerous meetings were held with the administration prior to the project, first to discuss the feasibility of the study, then to foresee any issues that might arise. There were unforeseen circumstances with regard to the technology, as previously discussed. Other teachers were affected, also. The seventh grade team gave up turns with the laptop lab in order for the science students to have one-to-one access to computers for the year. Colleagues were further involved as the participating teacher shared the successes and challenges of the project. Communication between teachers became more important for replication of the networked learning model in future classrooms. Due to the unique nature of the project and it's association with a university study, parents were notified and required to sign permission slips. The teacher maintained regular contact with the parents. The nature of the personal learning environments was such that students could easily share their work with family members at home. Finally, the students were constantly reminded of the responsibility that accompanied the freedom they were given with regard to Internet access. The school had previously developed an acceptable use policy, but it had not been actively taught in the past. The value of digital responsibility in managing student behavior cannot be overemphasized and is covered in greater detail under student processes.

The researcher and participating teacher made the best preparation attempts possible without the benefit of hindsight. Upon reflection, the advice offered herein takes into account the lessons learned based on the first iteration design. Once these preliminary considerations are followed, the preparations move from systemic to curricular. Insight gained from the processes students went through when constructing personal learning environments in their seventh grade science class support a revised Networked Student model for future project designs.

Evolution of the Networked Student Model

This study to determine the processes students go through when constructing personal learning environments was informed by a Networked Student Model based on information management and tools.

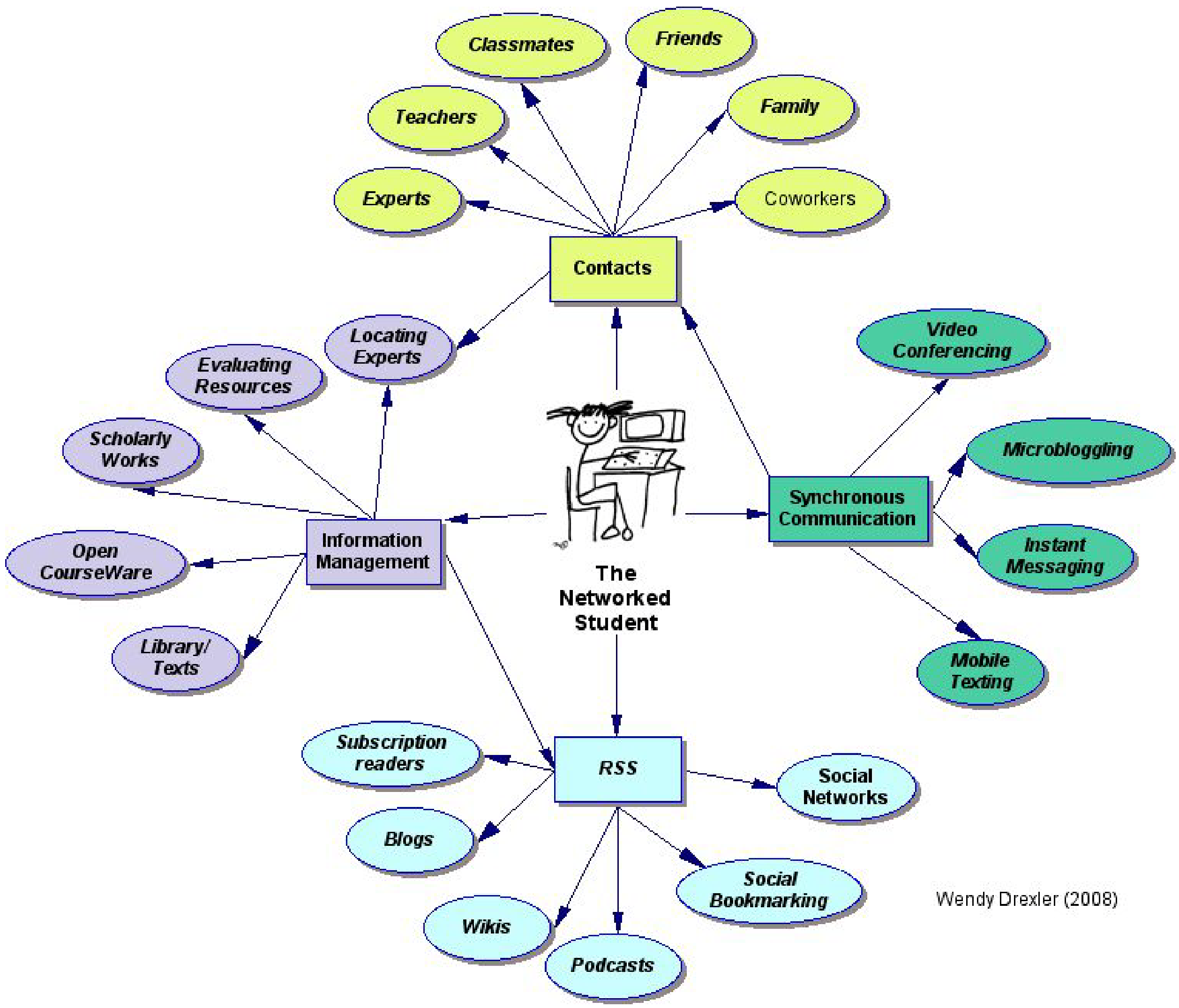


Figure 5-1. Original Networked Student Model

The purpose of the model in figure 5-1 was to present the various connections that comprise a personal learning network. It assumed connections with human contacts via face-to-face or synchronous communication tools (see top and right quadrants). Information management was identified as the key process. Numerous information and RSS tools supported user access and subscription to content (left and bottom quadrants). It offered a basic view of the student's potential network connections with people and information. From a design perspective, the student or teacher could refer to this diagram to create a personal learning environment based on any combination of these network connections.

This model made sense for supporting the initial instructional design based on the multiple Web applications that could be engaged to create a learning experience. It was a model organizing tools and human connections. The goal of this case study was to identify the processes students went through when constructing personal learning environments. Once those processes were documented, a different lens was available through which networked learning could be envisioned. Amiel & Reeves (2008) encourage researchers to rethink educational technology as a system and recognize the processes supported rather than the tools deployed. A tool itself will not transform education (Amiel & Reeves, 2008). Research in technology should be informed by an understanding of technology as a process. "Tools are merely the product of a technological system" (Amiel & Reeves, 2008, p. 32). With this view of technology in mind, the networked student model was redesigned to focus on the processes students went through when constructing a personal learning environment rather than the specific tools used to build it. The tools remain as a subset of the model, but are important only in how they support the processes.

The following process themes were identified through this design-based research study.

- Practicing digital literacy
- Practicing digital responsibility

- Organizing content
- Dealing with technology
- Collaborating and socializing
- Synthesizing and creating
- Taking responsibility and control for learning

As a result, a model evolved with a focus on these processes. Key connections (Information Management, Contacts, Synchronous Communication, RSS) moved into the appropriate supporting role under one or more of five key processes (Practicing Digital Literacy, Practicing Digital Responsibility, Organizing Content, Collaborating and Socializing, and Synthesizing and Creating).

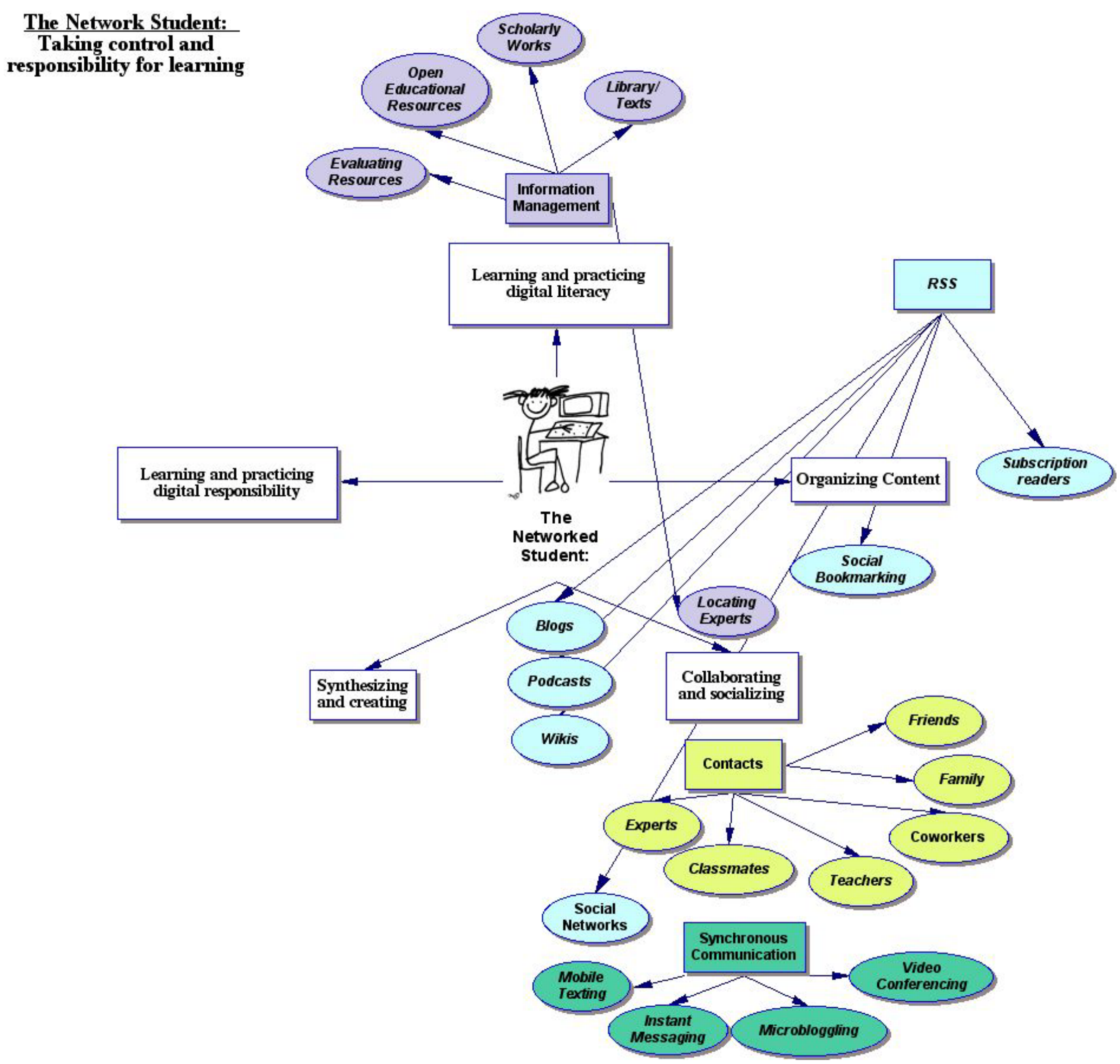


Figure 5-2. Evolving Networked Student Model

Dealing with technology fit under the category of practicing digital literacy. Taking responsibility and control for learning represented all the processes in combination. The remaining five processes encircled the networked student. The original tools and contacts were rearranged into the processes they support. Figure 5-2 represents that shift.

Some tools supported more than one process. Blogs, podcasts, and wikis support synthesizing and creating, as well as collaborating and socializing. Social bookmarking supported organizing content in addition to collaborating and socializing. Examining the processes in addition to connections added depth to the model. Areas were uncovered for which few if any tools had been identified to support observed student processes.

From an instructional design and research perspective, these are areas for further exploration to determine if supporting tools are available and whether students will further benefit from direct instruction. For example, Practicing Digital Responsibility had no supporting tools on the transitional diagram. Yet, filtering software, creative commons, copyright guidelines, and school acceptable use policies are potential tools in this category. They simply were not addressed in the previous model.

A revised vision of the networked student incorporated some missing tools and completed the transformation (Figure 5-3). As in a flowchart, the rectangles in the revised model represent processes. The diamonds represent decisions. When constructing a personal learning environment, the student (or teacher facilitating networked learning) makes a decision about the proper tool to use in support of a given process. Students are challenged to determine which tool is most effective.

Unfortunately, research indicates students are not necessarily capable of selecting the optimal tool for the learning objective (Clarebout & Elen, 2007).

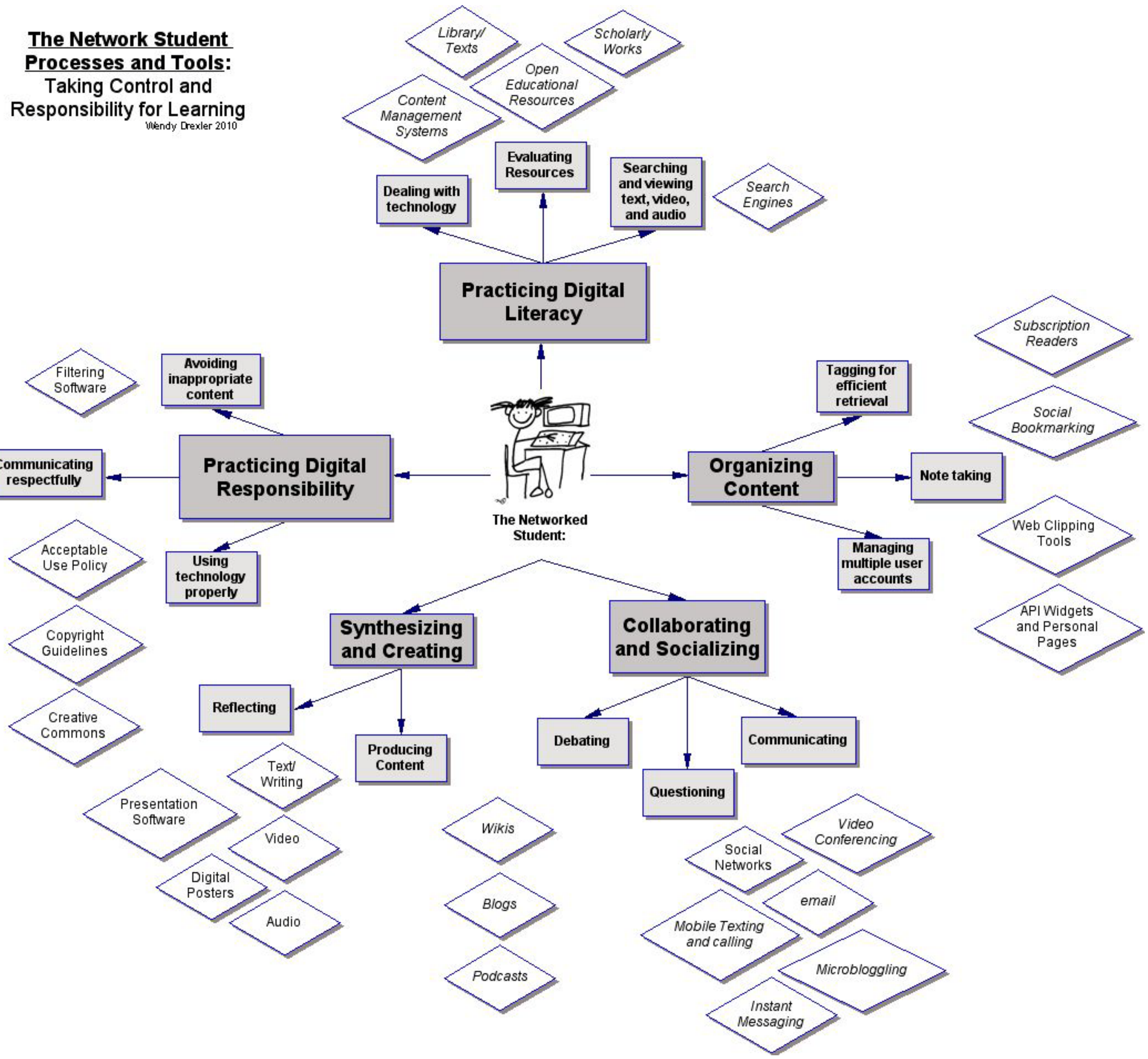


Figure 5-3. Networked Student Process Model

Based on the findings of this study and the value of guided instruction (Mayer, 2004) in an open learning environment (Clarebout & Elen, 2007), the teacher is challenged to develop a design that strikes the delicate balance between structure, guided instruction, and student directed inquiry. Again, the goal of personal learning is to empower the student to independently construct rich, effective networks in support of his or her learning objectives. Effective independent inquiry does not happen automatically (Mayer, 2004). This design-based research study further indicates direct instruction, guided inquiry, exposure to numerous tools, and practice provides a foundation on which a future of independent personal learning is built. Principles of design for future iterations are based on the revised Networked Student Process Model.

Design Principles for the Construction of Personal Learning Environments

Preparation guidelines presented at the beginning of Chapter 5 set the stage for implementation of instructional design. Teachers who wish to facilitate student construction of personal learning environments are encouraged to refer to the Networked Student Process Model as a guide. Opportunities to practice digital literacy, practice digital responsibility, organize content, collaborate with others, synthesize, and create content can be crafted into the student learning experience.

Scaffold Digital Responsibility with Set Expectations and Consistent Consequences.

Digital responsibility requires direct instruction and a concise set of expectations. To some extent, the age of the student will dictate the amount focus in this area. K-12 learners have greater restrictions to content than adult learners. However, the processes of avoiding inappropriate content, communicating respectfully, and using technology appropriately are applicable to children and adults. Tools such as filtering software and acceptable use policies apply primarily to K-12 students. Copyright guidelines and creative commons apply to all.

Filtering software is common in K-12 schools. The Children's Internet Protection Act (2001) implemented in the United States by the Federal Communications Commission specifies that schools and libraries may not receive E-Rate government funds “unless they certify that they have an Internet safety policy that includes technology protection measures” (Federal Communications Commission, 2001). Blocked sites differ depending upon school and network administrator philosophies. Negotiating the procedure for unblocking sites is part of the process presented previously under preparations for networked learning. Filtering software is a helpful tool in securing a safe Internet experience for younger students. However, it is no substitute for direct instruction and adoption of a school-wide acceptable use policy outlining expectations and consequences for misuse of technology. If starting from scratch, teachers can begin to build an acceptable use policy (or responsible use policy as some call it) based on Ribble’s (2004) nine general areas of behavior that make up digital citizenship.

1. *Etiquette:* electronic standards of conduct or procedure
2. *Communication:* electronic exchange of information
3. *Education:* the process of teaching and learning about technology and the use of technology
4. *Access:* full electronic participation in society
5. *Commerce:* electronic buying and selling of goods
6. *Responsibility:* electronic responsibility for actions and deeds
7. *Rights:* those freedoms extended to everyone in a **digital** world
8. *Safety:* physical well being in a **digital** technology world
9. *Security* (self-protection): electronic precautions to guarantee safety

(Ribble et al., 2004, p. 7)

Many state departments of education offer guidelines for creating acceptable use policies. For example, Virginia requires the following components:

- Description of the instructional philosophies and strategies to be supported by Internet access in schools

- Statement on the educational uses and advantages of the Internet in a school or division

- Statement that the AUP complies with state and federal telecommunication codes, laws, and regulations

- Statement regarding the need to comply with fair-use laws and other copyright regulations while accessing and utilizing the Internet and other network materials and resources

- Disclaimer absolving the school division, under specific circumstances, from responsibility

- List of the roles and responsibilities of division personnel, community stakeholders, parents, and students for using the Internet and other electronic-based resources

- Description of the safety measures currently in place and those measures planned for emerging technologies not currently deployed in the system

- Description of the methods by which the division ensures data and network security

- Description of prohibited forms of technology-based applications and hardware use by employees and students in addition to details of associated penalties (including clear definitions of acceptable online behavior and access privileges—reflecting any circumstances unique to a specific school or division)

- Description of the procedures to address breaches of Internet and intranet security and safety, including legal actions to be taken

- Description of the ongoing professional development opportunities for each stakeholder group and associated needs assessments and evaluations

- Description of the community outreach activities and associated needs assessments and evaluations

- Description of the procedures for evaluating and revising the AUP

- Signature form for teachers, parents, and students indicating their intentions to abide by the AUP

(Virginia Department of Education, 2010)

Schools often incorporate the acceptable use policy into the yearly student handbook. Parents and students sign these documents at the start of the school year, yet many are not aware of the details residing within. Direct instruction is necessary for parents and students to take the document seriously and understand the consequences if guidelines are not followed.

The process of practicing digital responsibility also refers to proper citation of resources, following copyright guidelines, and understanding creative commons. One of the most repeated words of advice from subject matter experts who reviewed student projects was to give credit to the work of others and cite sources when using that work. The ease of copying and pasting and using multimedia tools to manipulate content are creating new legal challenges to existing copyright law. Temple University's Code of Best Practices for Fair Use in Media Literacy Education (2009) provides educators with guidance and suggestions for teaching about copyright. Creative Commons offers authors and other creators additional flexibility in the way they license their work for others to use.

> Creative Commons is a nonprofit corporation dedicated to making it easier for people to share and build upon the work of others, consistent with the rules of copyright. We provide alternative licenses and other legal tools to mark creative work with the freedom the creator wants it to carry, so others can share, remix, use commercially, or any combination thereof. (Creative Commons, n.d.)

The creative commons and copyright decision points on the Networked Student Process Model overlap the processes of practicing digital responsibility and synthesizing and creating. A solid understanding and appreciation for copyright is essential in order to synthesize and create new works based on the contents of others.

Scaffold Digital Literacy and Integrate Opportunities to Practice

It would be nice to assume that students come to a class with foundational skills in searching, evaluating, and creating online content. The researcher's experience with elementary, middle, high school, undergraduate, graduate, and adults reveals few seasoned information consumers. While some researchers talk of digital natives and their uncanny ability to master innovative technologies (Prensky, 2001), further research challenges this assertion (Selwyn, 2009). The reality of young people's digital technology use is "passive consumption of knowledge rather than active creation of content" (Selwyn, 2009, p. 372). Such generalizations about the technological prowess of a generation fail to differentiate between the concept of digital native and digital learner (Bennett et al., 2008). Observations of students in this study support that finding. Most students were comfortable using home computers for email and social networking. Mobile technologies were used primarily for texting and Web surfing. Yet, students had little exposure to uses of technology for learning. Technology integration in prior grades was inconsistent or virtually non-existent. The lack of experience with educational technology was evident in student behaviors observed in this study. Searches were most often limited to the first few returns on a Google search. Students did not differentiate between opinion and fact or critically assess content authors. They were quick to believe in the Pacific Northwest Tree Octopus simply because the content was on the Internet. Questions related to content were initially directed toward classmates or the teacher, even though the information was easily accessible at the students' fingertips. Furthermore, most students were frustrated and paralyzed when encountering technical difficulties. Most of this frustration was eliminated when the teacher provided guidance on how to deal with issues. Until digital literacy is consistently integrated into elementary curriculum and students are given multiple opportunities to search and evaluate content, networked learning facilitators will have to provide specific, direct instruction on principles of digital literacy. This includes evaluating resources, modeling technology troubleshooting, conducting effective searches, and triangulating sources to support content.

The Networked Student Process Model provides decision points for accessing content previously evaluated by others. These include: open educational resources (managed and created by educators), scholarly works accessible through Google Scholar or library databases, textbooks, and traditional library resources. Content management systems offering open courseware allow students to access archived content or participate in real time courses. The search engine decision point is meant to represent the need for students to recognize search options, to understand there is more to a search than typing a few words into Google. Teachers looking for guidance on how to help students effectively validate information on the Web can consult Alan November's (2008) *Web Literacy for Educators*. November urges students to "get REAL" with the use of a four step process (November, 2008, p. 33). 1) Read and dissect the url. The domain name and extension tell a lot about the origin of the content. 2) Examine the content. 3) Ask about the author and owner. 4) Look at the links on the site and determine the back links (other sites that link to this site). The credibility of these resources offers insight into the potential credibility of the origin site.

Digital literacy is not a skill to be taught at the beginning of a unit and abandoned along the way. Students will continue to revert back to the easiest possible means of finding information regardless of the validity of the content. Continuous reminders and encouragement to dig deeper are critical to developing effective information managers.

Expose Learners to Processes and Tools through which they Collect and Organize Content

Processes that support organizing content include tagging for efficient retrieval, note taking, and the ability to manage multiple user accounts associated with organizational tools. Organizing content is a foundational process for constructing a personal learning environment. This is the area in which a developing networked learner can assume the most control once introduced to the supporting tools. A collection of tools selected for the purpose of this design-based research case study is based on the age of the student and seventh grade science curriculum. Specific needs of the learner such as age and learning objectives should be considered for future design iterations, as well. Though, students and instructional designers need not necessarily use the same tools as applied in this first design. There are countless Web applications available to the learner that could have educational potential. By the time this study is documented, there will be many more. Therefore, the decision points representing these tools are described by their function rather than suggested by name. Tools supporting organization of content include subscription readers, social bookmarking, web clipping tools, and personal pages aggregating API widgets. Examples are provided for clarification, though the researcher does not endorse a learner's use of one tool over another.

The original Networked Student Model identified Really Simple Syndication (RSS) as a key connection in networked learning. It is through RSS that users can subscribe to online content keeping track of changes as they occur rather than revisiting sites on a regular basis to see what has changed. Subscription readers provide a single repository for all content to which a user subscribes. Any blog, wiki, podcast, or Website with an RSS feed can be included in the reader. Those with new content will

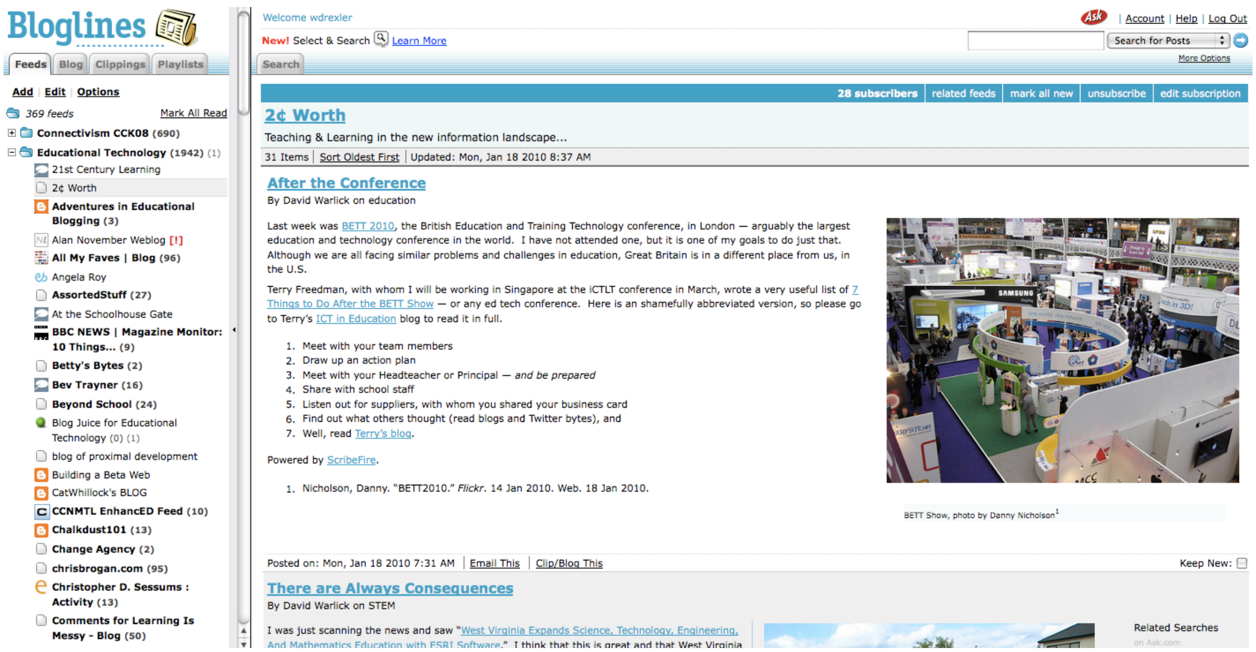


Figure 5-4. Example of an RSS subscription reader (Bloglines)

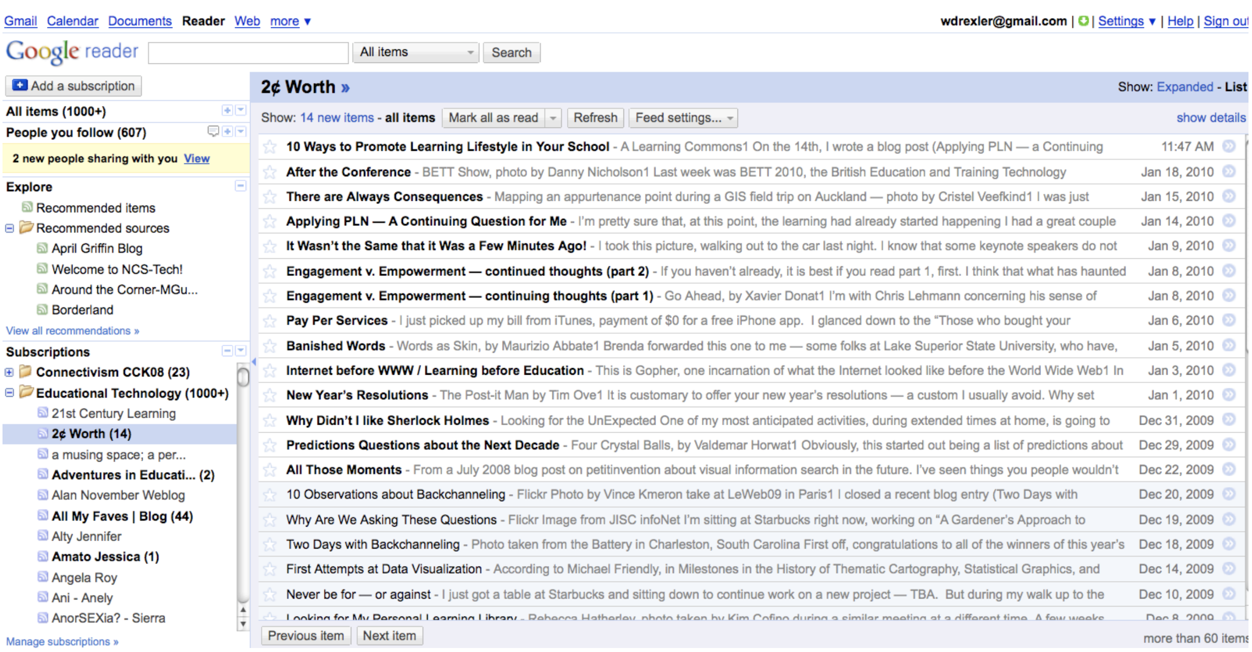


Figure 5-5. Example of an RSS subscription reader (Google Reader)

appear in bold type similar to a new email in a user's inbox. In the following example, folders within individual subscriptions are listed in the left navigation bar. Those that have been read appear in plain type. Those with new content appear in bold type. Clicking on a bold type subscription feed displays the new content in the main window of the reader. It is much easier to manage large quantities of changing content within this format. In some cases, the user can determine whether to further explore content base on the title of a post.

Social bookmarking tools provide a means for tagging and categorizing Websites to which the user would like to return at a later time. Key benefits include access to the bookmarks from any computer because the bookmarks reside on external servers rather than a user's hard drive and sharing of bookmarks with collaborators and other like-minded individuals. Some tools also provide the means for groups to add and share comments on bookmarked sites.

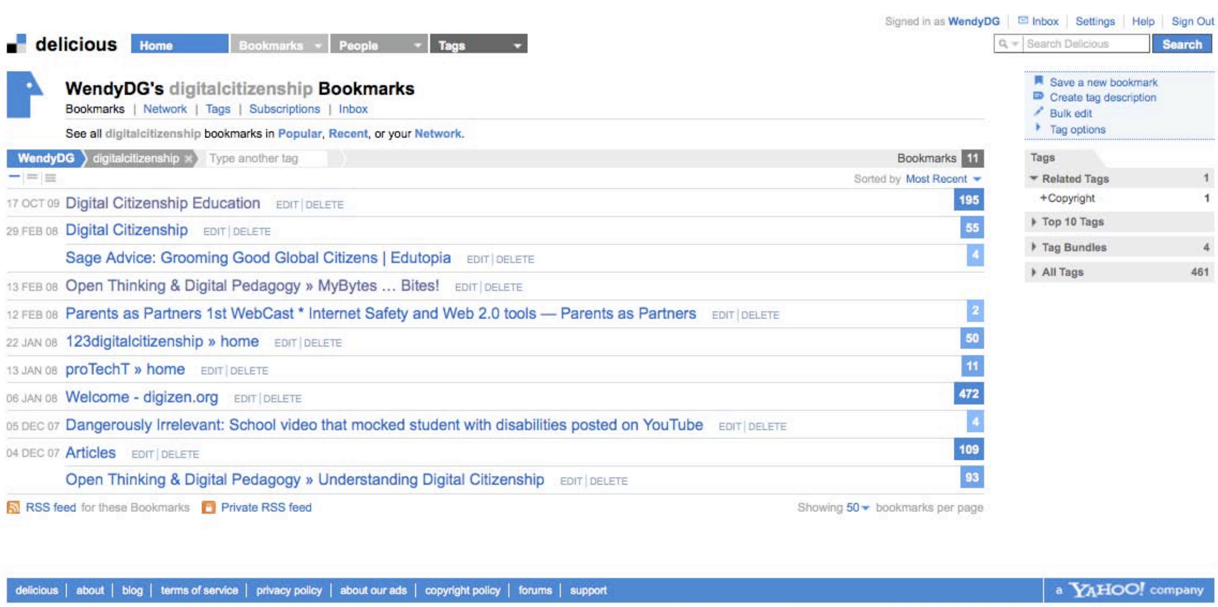


Figure 5-6. Example of social bookmarking (Delicious)

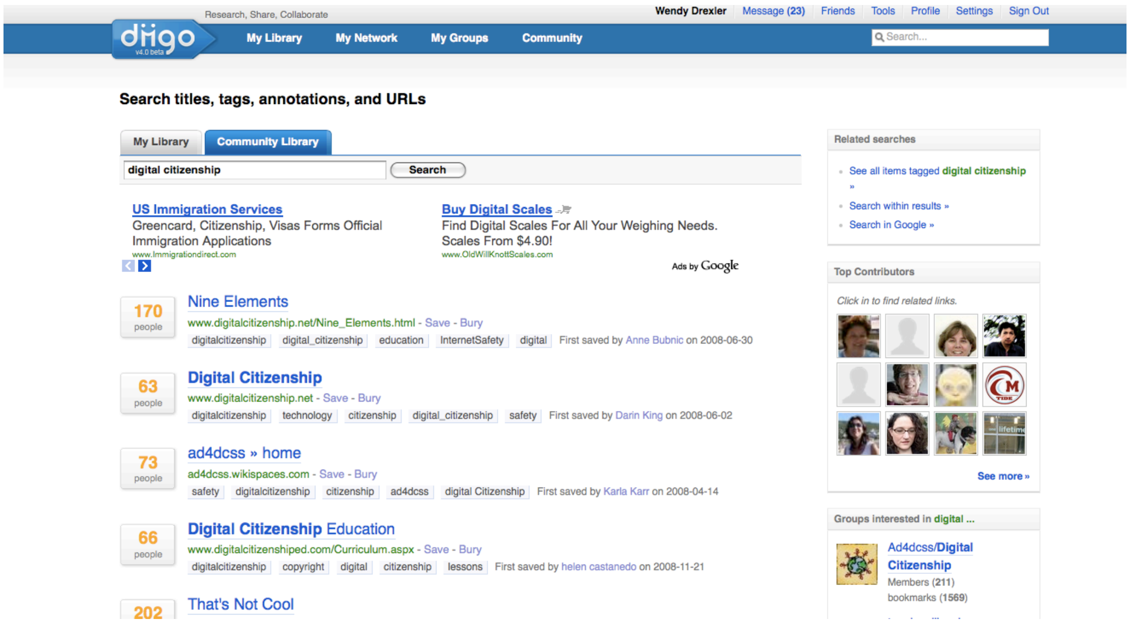


Figure 5-7. Example of social bookmarking (Diigo)

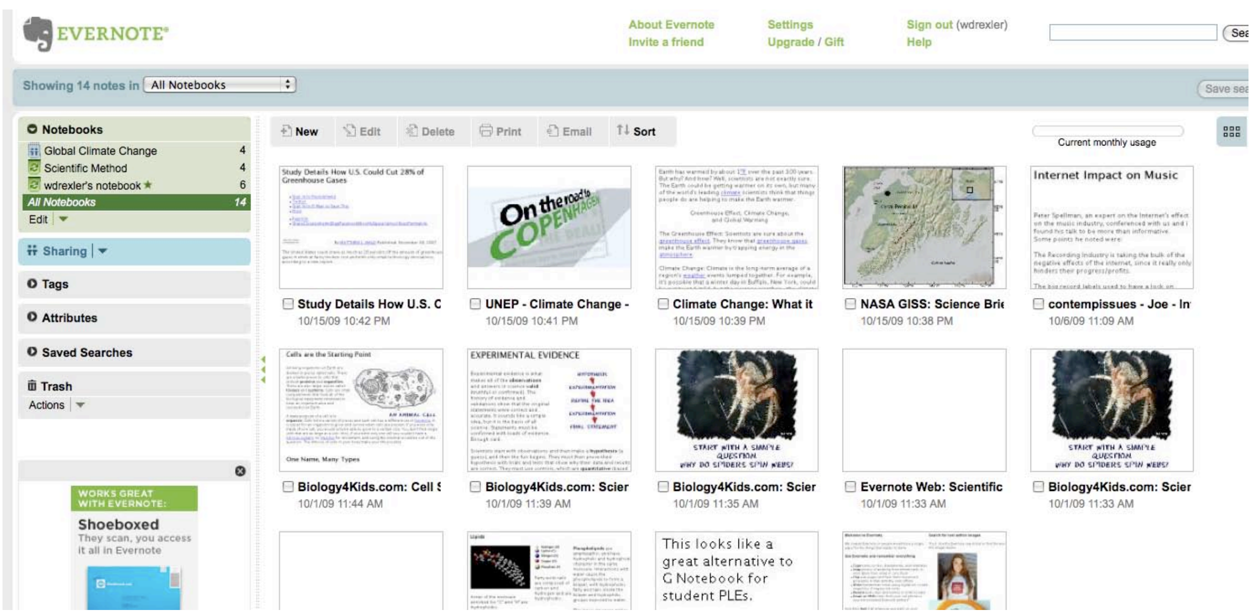


Figure 5-8. Example of Web clipping tool (Evernote)

Rather than bookmarking entire Web pages, learners may require only a portion of a site to support his or her research. In such cases, Web clipping programs provide a means for taking notes and capturing specific content from a site. The learner simply highlights the image and information needed, clicks on an icon in the browser, and assigns appropriate tags for easier retrieval.

Personal pages (Figures 5-9, 5-10, and 5-11) that combine API widgets offer an option for bringing tools and content together in one place. API widgets pull content from websites, RSS feeds, news feeds, games, social networking sites, and productivity programs. Symbaloo was selected for this design-based research case study because it was the only option with terms of service allowing students under 13 to use it.

The ability to explore and manage multiple Web application accounts benefits the learner in that he or she begins to appreciate the value of online organizational tools and recognize the plethora of tools available. Experimenting with numerous tools further fosters creative uses, comfort with technology, and common troubleshooting strategies.

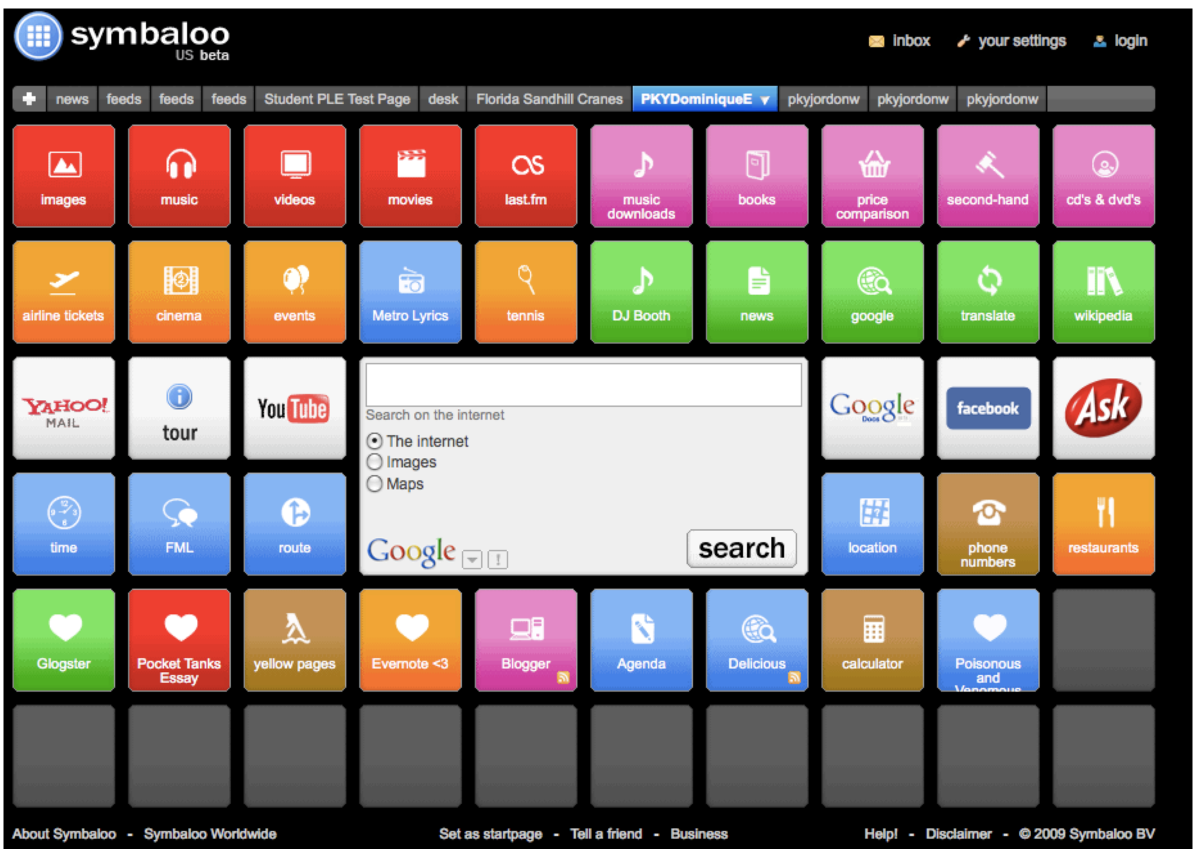


Figure 5-9. Example of personal page with API widgets (Symbaloo)

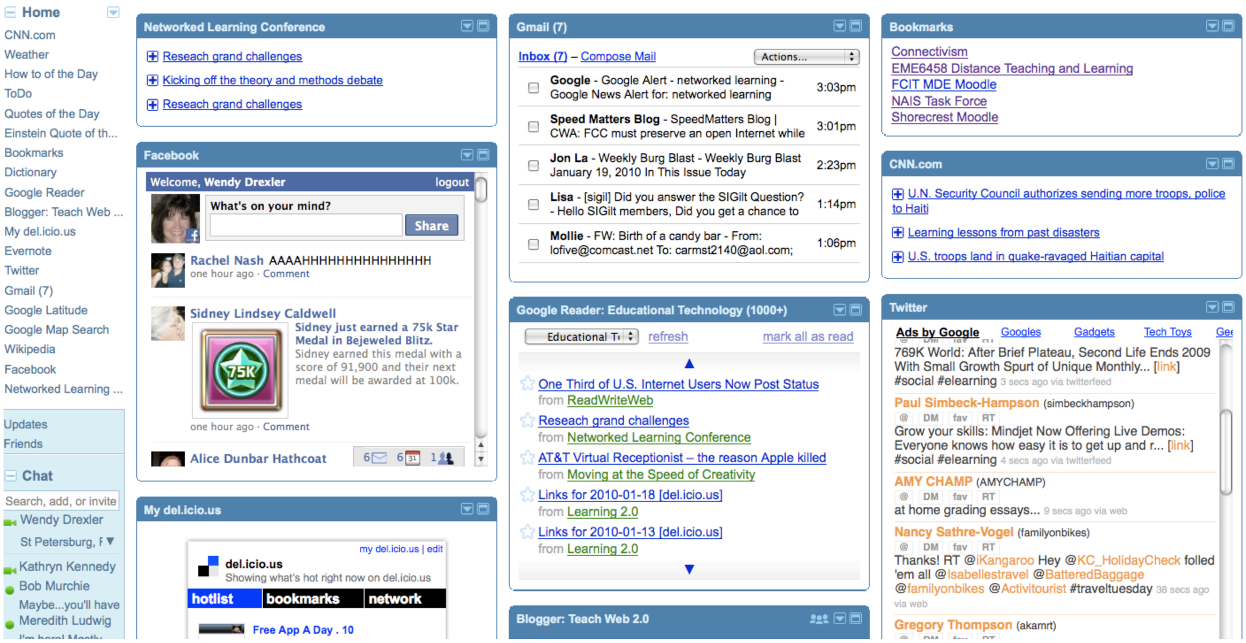


Figure 5-10. Example of personal page with API widgets (iGoogle)

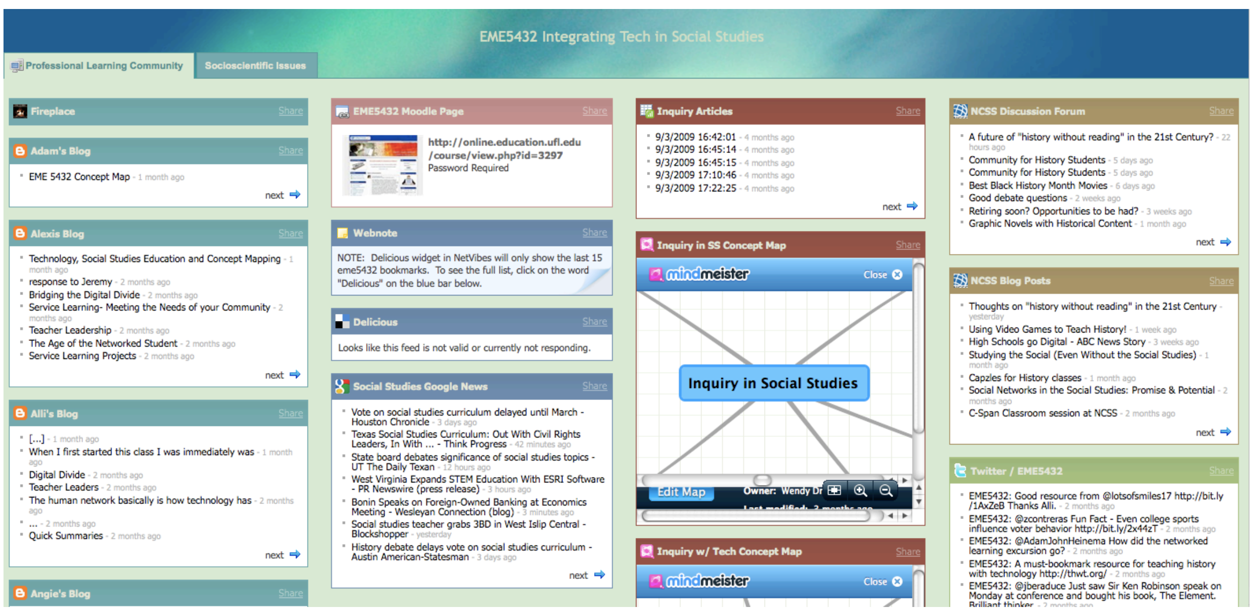


Figure 5-11. Example of Personal Page with API Widgets (NetVibes)

Facilitate Connections with Human Contacts to Support the Learning Process

Debating, questioning, and general communication with others are all part of socializing and collaborating for learning. Potential ties include other students, friends, family, teachers, and experts, as well as weak connections to brief online contacts. Dalgaard & Paulsen (2009) assert that “individual learning is conducted alone, collaborative learning depends on groups, cooperative learning takes place in networks,” and technology has the potential to support all three (Dalgaard & Paulsen, 2009, p. 5). Students decide how to make connections with others via a number of communication tools including mobile technology, email, video conferencing, instant messaging, microblogging and social networks. Contact is also made through the creative works of others (e.g. blogs, wikis, podcasts, videos, articles, and books).

Access to subject matter experts on virtually any topic is easier than ever in past human history. Such contact allows the learner to benefit from the experience of those who learned before. The findings from this research indicate aspiring networked learners require guidance on how to find experts and respectfully request their assistance. Findings further confirm the willingness of experts to respond to students, offer guidance, and share their knowledge. Providing opportunities for students to construct personal learning environments that include network connections to others gives them the foundation on which they can independently build a future of life long learning and form these contacts on their own.

Scaffold Reflection and Synthesis of Content through Creation of Original Works

Reflection is an important aspect of metacognition and self-regulation in learning (Bransford et al., 2000). “The best learning takes place when learners articulate their unformed and still developing understanding, and continue to articulate it throughout the process of learning” (Sawyer, 2008, p. 53). Since blogs are basically a digital journaling tool, they offer a means for daily reflection within the personal learning environment. Here are two examples of reflections posted by seventh grade students in this study.

1. I came back in and they were working on cells. Luckily, I had some background knowledge from 5th grade with Mrs.B. The words we worked on are things that would be in Pond Water. Such as: Animals, Plants, Protists, Fungi, and Bacteria. We then put them in an Evernote page. Next we had to make a scientific paper on what is in the pond water. I didn't have to time to look at the pond water, because I finished the first part of my scientific paper first. Next class my goal is to finish my scientific paper. Today I rate myself a 9 (Student A blog post, November 17, 2009).

2. This is the red blood cell. You have many blood cells. The cells in the body work like a factory. Red blood cells carry oxygen through your body. White blood cells attack viruses. They are the warriors of the body. Each cell has a nucleus. The nucleus is the brain of the cell (Student B blog post, December 10, 2009).

The student writing in the first example identifies the background knowledge that supports the new lesson. She describes some of the steps in the learning process and rates her performance for the day. The student in the second example reflects primarily on the critical content of the lesson. Whenever possible, the student is directed to search exhaustively for information that supports full comprehension of the materials. This may require deeper searching to get answers to questions. In the reflective writing process, the student focuses on exact meaning as well as what he or she does not understand or would like to have clarified (Kalman, 2008). Questioning, making connections, self-assessment, and goal setting are important components of reflection (Wilson & Jan, 2008). Blogs, wikis and podcasts appear on the Networked Student Process Model between collaboration and creation because they serve both purposes. They can be used to connect with others or to share the student's own thoughts, ideas, and reflections.

Creativity and innovation are critical 21st century skills (Partnership for 21st Century Skills, 2007). Richard Florida (2002) writes of the creative economy, the creative class, and their impact on everything from education to the development of successful urban centers. Technology continues to offer new outlets for creativity through audio, video, textual, and integrated tools. As it becomes easier for students to co-create educational content, it also becomes more important to teach the responsibilities that accompany that freedom. For this reason, creative commons and copyright fair use overlap practicing digital responsibility and synthesizing and creating. Students must be informed on the proper use of these tools when repurposing the works of others.

In summary, Chapter 5 outlines design principles based on a Networked Student Process Model informed by the findings of this design-based research study. The teacher or instructional designer who seeks to facilitate student construction of personal learning environments should prepare accordingly and refer to the model addressing the principles identified therein. As previously stated, this model assumes a networked student in training. The ultimate goal is to nurture a process that is self supported and empowers the learner toward effective personal formal and informal life long learning. Chapter 6 will discuss implications based on the findings and design principles as well as suggestions for future research.

CHAPTER 6
CONCLUSION

This chapter begins with a brief summary of the design-based research case study followed by a discussion of how the findings compare to the literature. Implications are presented for student participants, teachers, policy, and delivery methods. Recommendations are made for further research in networked learning and construction of personal learning environments.

Summary

A single-iteration design-based research case study was conducted at a K-12 school in the southeastern United States. The purpose of this study was to answer the research question, what processes do students go through as they design a personal learning environment in a middle school science class. Approximately 100 seventh grade students participated in the project of which one class of 25 was observed. Two students from that class, one identified by the teacher based on standardized test scores as a high achiever, the other as a struggling reader, were observed in detail. The teacher designed and facilitated a nine-week unit on poisonous and venomous creatures that supported the student construction of personal learning environments for guided inquiry learning. Students selected a poisonous or venomous life form to study in greater depth. A number of Web applications were integrated into the personal learning environments including those for note taking, social bookmarking, blogging, video conferencing, creating digital posters, and aggregating content.

The following processes were observed as a result of this study.

1. Practicing digital literacy
2. Practicing digital responsibility
3. Organizing content
4. Dealing with technology

5. Collaborating and socializing
6. Synthesizing and creating
7. Taking responsibility and control for learning

These processes informed a model of the networked student that could be adapted for future networked learning implementations.

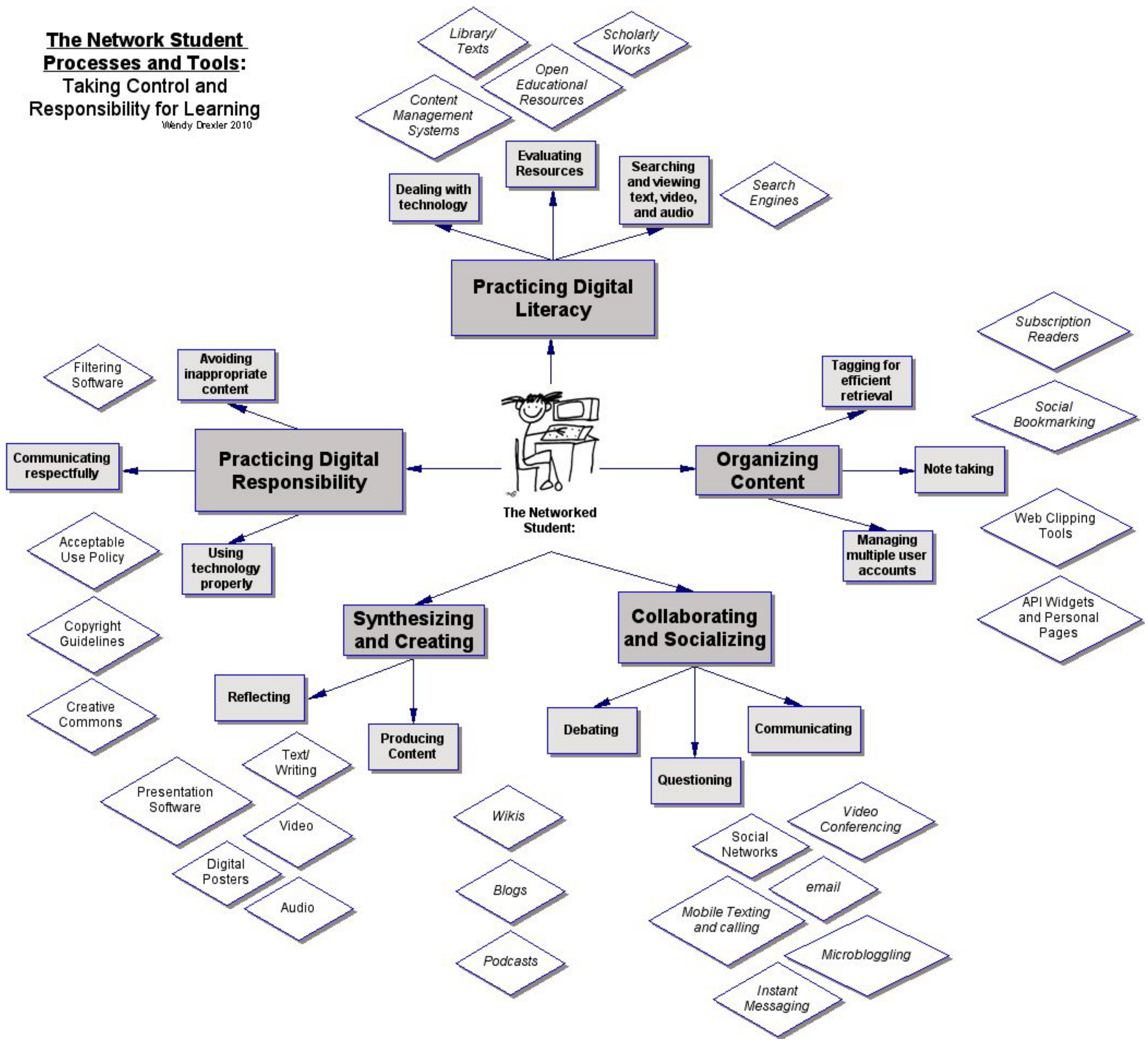


Figure 6-1. Networked Student Process Model

Comparison Of Findings To The Literature

The study represented a complex integration of technology in that many different Web applications were combined to create a personal learning environment unique to each student. As the teacher prepared and adjusted his facilitation of this project, he was mindful of the factors that influence learning outcomes. These included consideration of student readiness to accomplish the learning objectives, applying the most appropriate instructional strategies for the objectives, selecting the most suitable technology, and gauging his level of support based on student needs (Morrison et al., 2007). The teacher constantly made adjustments as evidenced in his daily agenda postings. He saw the need to scaffold the learning process (Turker and Zingel, 2008) for both the construction of the personal learning environment and the life science content.

One of the ultimate goals of the personal learning environment was for students to self regulate the organization of numerous resources into meaningful learning (Turker and Zingel, 2008). Zimmerman (2008) identified the phases students go through when working toward self regulated learning as forethought, performance, and self-reflection. The processes supporting these phases included goal setting, attention focusing, and self-evaluation (Zimmerman, 2008). The students in this study were embarking on the beginnings of self-regulated learning. They did not, nor was it assumed they would attain full self-regulation. They were, in effect, networked learners in training. The teacher facilitated goal setting, performance, and self-reflection by integrating these processes within the instructional design. Long-term goals were established at the start of the project. Short-term goals were shared each day in the agenda blog. Students performed based on assignments and guidance from the teacher. Self-reflection took place on the student blogs. As a result, the process of taking control and responsibility for learning was scaffolded by: practicing digital literacy, organizing content, collaborating and socializing, synthesizing and creating, and practicing digital responsibility. Research literature confirms the value of each individual process identified in this study.

Practicing Digital Responsibility

Ribble (2004) defines digital responsibility as “electronic responsibility for actions and deeds” (Ribble, 2004, p. 7). Acceptable online behavior is not something students will necessarily assume independently. The findings in this study were consistent with the research supporting direct instruction of digital literacy, responsibility, and citizenship. Children are often consumers of technology with little or no guidance from parents or teachers on how to behave in this environment (Botha & Ford, 2008). O’Brien (2008) suggested the adoption of a Bill of Digital Learning Rights that could be taught through a virtual online laboratory of democracy.

- Freedom of expression in an online environment
- Right to assemble in online environment for educational and civic purposes
- Freedom of access to appropriate and relevant online information
- Equitable access to the Internet and to the digital tools needed for learning
- Equitable opportunities to engage in global learning in an online environment
- Right to digital privacy
- Right to a digitally safe environment
- Equitable opportunities to contribute to an online democratic commons
- Equitable opportunities to engage in digital civic action

(O’Brien, 2008, p. 24)

These rights extend beyond those covered in this study. However, issues of access, freedom to assemble online and engage in global learning have tremendous implications, especially in schools and districts that limit student access to Internet resources. The students in this study had very limited Internet access at school prior to this project. They were the only students in this school with liberal access to the Internet. Such questions of digital responsibility as they are framed within the larger context of digital citizenship warrant further investigation. It seems that understanding how to navigate this online space should be a prerequisite for full participation, hence the need for digital literacy skills throughout the K-12 curricula.

Yet, fears associated with vague federal regulations often cause schools to take an extremely conservative approach with Internet site filtering. Public schools that receive e-Rate or EETT funding are required to comply with the Children's Internet Protection Act (CIPA). Bocher (2008) of the Wisconsin Department of Public Instruction offers a brief overview of the legislation in a series of frequently asked questions.

> Q: What has to be filtered or subject to the "technology protection measure?"
> A: The filter, referred to in CIPA as a "technology protection measure" (TPM), must protect against access to visual depictions that (1) are obscene, (2) contain child pornography, or (3) are harmful to minors. The first two prohibitions are defined in other sections of the federal statues. Obscenity is also frequently defined in state statutes and local ordinances using guidelines established in the Supreme Court's 1973 *Miller* ruling (413 U.S. 15). "Harmful to minors" is defined in CIPA. It takes the Miller definition of obscenity and applies it with respect to minors under age 17. In its April 2001 CIPA regulations (CFR 54.520), the FCC declined to "amplify the statutory definitions" in the law. It should be noted that even prior to CIPA no student or staff had a legal right to view obscene images on school workstations and child pornography is clearly illegal, regardless of the media used for viewing. Only a court can determine if an image is obscene. However, staff often must make a practical determination of this if the school's AUP is to be enforced. CIPA does not require the filtering of text or audio. (Bocher, 2008, n.p.)

At the time of the implementation of this study, the researcher was unable to find a single instance in which a school was denied e-Rate or EETT funding based on CIPA violations. This legislation must be reconsidered to determine whether it is protecting children or doing more to reinforce inconsistent limitations on student learning and potential achievement.

A balanced approach toward site filtering should be carefully considered when schools develop or revise their acceptable use policies. Filtering software alone is not the best solution, especially when savvy students use proxy servers to bypass school filters. Rather, a human approach that combines balanced filtering with direct instruction and a well-communicated set of expectations and consequences is suggested.

Practicing Digital Literacy

In *Multiliteracies for a Digital Age*, Selber (2004) differentiated three types of literacy. Functional literacy referred to the tools students use for technology. Critical literacy called for the development of students as informed questioners of technology. Rhetorical literacy defined a student's ability to become a reflective producer of technology. The findings in this study corresponding to digital literacy indicated the need for students to deal with technical issues, evaluate resources, and effectively search for content. Students dealt with numerous technical difficulties. Obstacles that could generally be expected when integrating technology for learning included: unreliable Internet connections, outdated computers, limited instructional freedom, and lack of administration support (Varma et al., 2008, p. 344). Varma's (2008) list was consistent with the technical frustrations experienced in this study with the exception of administrative support. There was significant support on the part of school leadership; however, there were numerous challenges with network administrative support.

Through the process of evaluating the validity of Web content such as the Pacific

Northwest Tree Octopus (Zapato, 1998) students learned to question content obtained through technology. Through their blogs and digital posters, they became reflective producers of content.

The students in this study further experienced five major digital skills as defined by Alkali and Amichai-Hamburger (2004). 1) Their photo-visual skills were tapped through the use of images and video in building their personal learning environment. 2) Reproduction skills were required in the completion of notes, blogs, and digital posters. 3) Branching skills, or the ability to "construct knowledge from non-linear, hyper-textual navigation (Alkali and Amichai-Hamburger, 2004, p. 421) were required for Web site navigation and the ability to synthesize that content. 4) Information skills were obtained and exercised with the evaluation of each new Web resource. 5) Socio-emotional skills were practiced in the digital responsibility guidelines set by the teacher and practiced by the students. Each of these five major digital skills was required for the students to effectively organize content.

Organizing Content

No literature was found specific to K-12 student organization of personal learning environments. Research on middle school student use of online resources, however, indicated inconsistencies in the students' abilities to effectively collect and synthesize online content (Hoffman et al., 2003), thus confirming the need for deliberate scaffolding in this area.

There were studies available relative to the sub-processes in the category of organizing content including tagging for efficient retrieval, note taking, and managing multiple user accounts. A case study conducted using the Delicious social bookmarking site, the same tool utilized in this study, highlighted the importance of tagging to support collaborative online learning and virtual learning environments (Saward & Pye, 2008). Students in this study were taught how to tag resources and consistently reminded to tag with as much detail as possible to facilitate synthesis of content for later use.

Observations in this study found inconsistencies in students' note taking detail and effectiveness relative to the detail included in their final digital poster project. A study of college students' copy and paste note taking behavior concluded that "students' personal approaches to copy-and-paste note taking vary considerably in terms of effectiveness, with the type of approach relating to how much is learned from Web-based text" (Igo et al., 2008, p. 165). This further supports the need to scaffold the note taking process and offer options and guidance in online note taking.

Password issues were the predominant concern related to management of multiple user accounts. Users tended to create simplistic passwords, use the same passwords for multiple accounts, and forget them (Charoen & Olfman, 2007). Young students who did not have experience managing multiple accounts seemed to have even greater difficulty. Some of the strategies suggested by the teacher in this study included writing the password in a notebook, recording it in the cell phone, and using the same password for multiple accounts. Unfortunately, this has implications for network security as more students participate in networked learning. It seems a systematic process for account management would be helpful.

The use of API widgets to organize online content for learning is very new, especially in K-12 classrooms. Taraghi et al. (2009) posed an interesting discussion on whether the use of API widgets for content mashups (such as the one represented by

Symbaloo in this study) can be used for learning, or whether they are simply a tool for refining and organizing information. Personalization indicates full control on the part of the user (Taraghi et al., 2009). At what point does teacher intervention take away the personal aspect of learning in this environment? The project highlighted in this study introduced networked learning and personal learning environments to the students. They did not assume full control as part of this first iteration design. Further design iterations are necessary over a longer period of time to determine at what point, if ever, the student assumes full control.

Collaborating and Socializing

Goodyear (2005) asserted that educators should create an environment supportive of building relationships for learning. His organizational forms (classes, study groups, project teams, roles, etc) indicated a number of design considerations for partnering or grouping students for social learning (Goodyear, 2005). In a peer-to-peer learning environment, the novices (students) work together to make sense of their learning (Haythornwaite, 2008). Expertise no longer resides solely with the teacher, but in all the potential contacts available in a network (Haythornwaite, 2008). The students in this study reached out beyond their teacher and peers to experts in the field. The responses they received from scientists all over the globe were evidence of the network's potential learning value. The debating, questioning, and communicating that took place in the classroom and online between classmates added to the discourse and students' understanding of scientific concepts associated with the project. Part of the learning process was designed to facilitate the student identification and contact of experts in the fields they were studying. There was no communication with peers outside the classroom as part of this first iteration design. Use of social networks that could potentially connect students to other classes or students around the world should be a consideration for future design iterations.

Synthesizing and Creating

The Partnership for 21st Century Skills (2007) and the International Society for Technology in Education National Educational Technology Standards for students (2007) both identify creativity as a necessary constructive process in learning. A key design consideration in this project was to facilitate students' opportunities to synthesize content related to a topic of study and repurpose that content in a new way. Providing them with the requisite skills to effectively synthesize content found online was a process that required continual facilitation on the part of the teacher.

In a study observing student use of online resources in a sixth grade science class, Wallace (2000) found that students lacked depth in their search for content. Ultimately, he concluded that synthesizing information on the Web was an extremely complex process and success was dependent upon teacher intervention (Wallace, 2000). The findings of this study were consistent with Wallace. Students required considerable encouragement to dig deeper and look beyond the first few Google hits. They seemed to enjoy the creative process of designing the digital posters, but the depth of content varied greatly between the students. Leveraging feedback from expert scientists to motivate students to correct and revise their work appeared effective. More time is needed to continue to scaffold student digital literacy and information synthesis skills.

Literature addressing the complex integration of many Web applications for learning in middle grades was lacking. However, existing research on the individual processes observed in this study were consistent with the findings herein. This is not surprising considering existing literature was taken into account as part of the first iteration design process. Individually, the results within each process are not as compelling as they are when considered as a whole. The biggest surprises in the study were related to the impact school policy has on the potential success of networked learning and the variation in student perceptions based on their prior success in school. These are both areas warranting additional attention. Implementation of future iterations of student construction of personal learning environments has implications for students, teachers, district policy, and delivery mediums.

Implications For Students, Teachers, and Policy

Students in this study continued to maintain their personal learning environments and practice networked learning for the remainder of their seventh grade year. There were no provisions in the school program for providing similar opportunities in eighth grade or after. Presumably, these students moved on with the traditional curricula. If their exposure to technology at the school prior to this study indicated future technology integration, their opportunities to take advantage of online resources remained inconsistent across the curriculum and upper grades. It was not clear how their participation in this study affected their attitudes about returning to a traditional format. Most of the students had access to technology at home and took advantage of the option to complete or continue work outside of class. The increased comfort with technology and Web applications may have encouraged self-directed exploration for future learning, as well as online social behavior. It would be interesting to follow up with this group to better understand the implications of their participation in this case study.

Teacher practice was significantly altered as a result of implementing the first iteration design. In spite of the challenges, the participating seventh grade science teacher reflected he could not imagine returning to the way he previously taught. This was especially interesting, as this teacher was already known for his constructivist teaching style. At the same time, he had numerous conversations with other teachers at the school, most of whom would not consider a networked learning approach. Each expressed concern about the reliability of technology and time constraints that resulted from dealing with the technical difficulties. Teachers also worried about student behavior, access to inappropriate materials, and general lack of control. Further research is necessary to confirm, but presumably this would be a common concern for many teachers and a limitation of implementing wide spread use of networked learning in traditional K-12 schools. The scalability of networked learning is dependent upon changes in school policies, hiring practices, and pre-service teacher education. Some teacher concerns are the result of a system in which strict policies, high stakes testing, and a desire for control constrain teacher autonomy. Others are the result of roles that are ingrained in teachers through their personal school experiences and further reinforced in most pre-service education programs.

The roles of the teacher changed drastically in this environment. There was little if any lecture, considerable technology trouble-shooting, and a lot of one-on-one or small group facilitation. Student success depended on his or her motivation but also greatly on the strategic guidance of the teacher. The teacher's ability to gauge student's understanding and progress were key to achieving the delicate balance between student autonomy and teacher intervention. Adopting a networked learning approach would require considerable teacher professional development and a philosophy different from that of most current educators. The implications of the latter on the potential of networked learning are far reaching. They extend to school policy, hiring practice, and pre-service teacher education.

Many school policies hindered the success of this first iteration design. There was a technology acceptable use policy (AUP) in existence, but students were only minimally aware of its contents. Numerous Websites were blocked. Access to sites and applications was greatly restricted. This design could not be replicated or improved upon without significant changes to school policy. Administrative support was excellent, however the research team underestimated the need for network administrative support in addition to leadership support. The network administrator was concerned for the safety of students and their use of online resources. He had valid concerns.

Applying networked learning on a school or district-wide basis would require sweeping changes in policy, the assumption of greater risk, and support of teacher professional development. Parents and community members would have to be part of the conversation leading to these changes. One of the most difficult obstacles would be determining how much access is warranted. How does the school or district balance access with safety? What is their real liability? How are students made aware of expectations? What kind of training is effective for teachers? How much technology integration is expected as part of the job requirement?

Another major issue and teacher concern is assessment. It is not clear how networked learners would do on standardized tests for accountability. Teachers are well conditioned to build their curriculum around these tests. Even those who do not teach to the test are mindful of the need for their students to show progress. Some of these political implications indicate that networked learning and the construction of personal learning environments may have greater chance for implementation in non-traditional schools.

Implications for Delivery

This first iteration design-based case study was conducted in a traditional school with conservative access to computers. Design was impacted by the need to work around those applications for which access was delayed or restricted. Students did not have unlimited access to computers. A rolling laptop lab was used. Students were unable to save files to the individual laptops because policy was in place to limit downloads on individual machines. Nor would this have been practical considering many students used each computer during the course of a school day. Design may have been better supported in a laptop school in which many of the policy considerations have been taken into account before implementing a 1:1 computer ratio. In such an environment students would have increased control over the computer along with the ability to use it at home to extend learning experiences beyond the school day.

Expanded learning time (ELT) through distance education has the potential to increase student learning, provide individual attention, incorporate more professional development, and make time for extracurricular activities (Cavanaugh, 2009). A blended approach, one that combines the best of face-to-face with online instruction, would be a more effective outlet for a networked learning design. Time spent face-to-face with students would be best used for collaboration with other students and individual guidance from the teacher. The student would then be free to focus time outside of class on Internet research, communication with experts and peers around the globe, and building the personal learning environment. A guided approach in a blended environment facilitates independent learning (Cavanaugh, 2009). Furthermore, students learn how and when to ask for guidance (Cavanaugh, 2009) creating a foundation on which 21st century students can build life-long learning skills. One of the most important design implications as highlighted in this study is the need for deliberate scaffolding in a networked learning approach. Similar to guided inquiry (Mayer, 2004), the student construction of personal learning environments is best facilitated with strategic guidance from the teacher. A blended learning delivery may provide a better outlet for a networked learning design. Furthermore, most students who use their own computers in a blended or online learning environment have less restricted access to Internet resources at home than at school. While this may bring up issues of safety beyond the realms of this study, it also offers increased direct access to many educational Web applications that could be inadvertently blocked by the school network.

Hence, there is also potential for implementation of networked learning in a fully online virtual school. One benefit of online learning is the access it provides to a wider range of courses (Cavanaugh, 2009). Implementing networked learning for the student construction of personal learning environments extends study to virtually any topic. Teacher facilitation and guidance is still a requisite part of the process, but could be conducted easily in the online environment through synchronous and asynchronous means. Again, virtual school relies on network access from a remote location. If the student is learning from home, there are fewer concerns about restrictive filtering. Parents could monitor online behavior as necessary and even support the student's efforts along with the teacher.

Suggestions For Further Research

This first iteration design defined the processes students go through when constructing personal learning environments in a seventh grade science class. Design considerations highlighted in Chapter 5 were based on those processes, but other instructional options were available that were not fully explored in this study. Future iterations might benefit from greater use of open educational resources including full online courses that could be further supplemented by networked learning activities. For example, a student might access an online course in life science while supplementing his or her study with other online resources such as video and podcast lectures as well as contact with subject matter experts. Social networking sites provide opportunities to connect to many like-minded people. There is further learning potential through these connections. All these resources grouped together in the student's personal learning environment could provide for a richer learning experience.

Research with other grade levels as well as adults is warranted along with varying content areas. Such studies could determine how design is affected by age of student or how design might change for a math or literature inquiry versus science. Longitudinal studies are needed to fully determine whether students eventually take greater responsibility for the learning process over time. Will the student become self-directed or continue to look to the teacher for guidance? At what point, if any, will a student take over full learning control? Given the entire Internet for potential resources, will students seek out every learning node possible, or will they continue to revert to the easiest search method, stopping at the first answer they encounter? Students in this study searched images most often. Without teacher intervention, will students continue to focus on the resources with which they are most comfortable? How hard will they try to form new connections?

Design thinking (Brown, 2009), a concept originally conceived for business product-design shows promise in classrooms (Goldman et al., 2009) and may begin to address some of the issues of self regulation. Design thinking is human-centered, action-oriented, and mindful of process (Goldman et al., 2009). The personality traits of a design thinker include empathy, integrative thinking, optimism, experimentalism, and collaboration (Brown, 2009). The general idea is to think about design from an end-user and big picture perspective. Consider what the user needs and begin building with ongoing prototyping to test ideas and make adjustments. Brown (2009) refers to this as building to learn. In effect, students who design personal learning environments are building to learn, and these learning structures are easily shared online. Perhaps if students view the personal learning environment as a creative process from which others can learn, they will attend to the quality of work, be mindful of process, and explore the supporting content in greater depth. Further research is needed to determine whether applying a design thinking process has an impact on self-direction or the depth at which students apply the research process to their personal learning environments.

One of the most elusive research questions within the field of education and educational technology is how to measure whether learning has taken place. The results are further challenged by the means with which educators measure student success. Are standardized test scores a valid or accurate measure of the quality of personal learning or are we in need of alternative assessments that focus on the 21st century skills required to navigate in this environment? Further research is required to address this question to determine the best means of assessment. Perhaps there is more to measure than simply content knowledge. An assessment of a student's ability to effectively execute each of the processes identified in this study may serve as a better assessment goal. Developing a set of competencies within each process and measuring the student's ability to perform is the first step toward acknowledging personal learning as a valuable 21st century skill. The goals of learning can be different when trying to manage complex skills. The student first works toward a process goal "perfecting the form or procedure that the skill involves without regard to the final outcome, then shifting attention to the product goal once the procedure is more automatized" (Ormrod, 2008, p. 526).

From a teaching perspective, networked learning has implications for teacher roles and professional development. Networked learning blends the concept of educator expertise with learner construction (Siemens, 2007). Siemens (2007) views the role of teacher as curator, an expert learner who creates spaces in which knowledge can be created, explored, and connected.

> While curators understand their field very well, they don't adhere to traditional in-class teacher-centric power structures. A curator balances the freedom of individual learners with the thoughtful interpretation of the subject being explored. (Siemens, 2007, p. 17)

The teacher in this study had characteristics quite different from most of his teaching peers. Is there a certain skill set associated with teachers who facilitate networked learning, or does it have more to do with disposition and teaching style? Teacher beliefs about the value of technology as a teaching tool may determine effective integration more than traditional forms of professional development (Mueller et al., 2008). Administrators should consider whether it is even possible, practical, or prudent to require teachers to change their teaching paradigms to adopt a networked learning approach. Such a radical departure from traditional curriculum and pedagogy will require teacher buy-in. Even in an organization in which the culture supports innovative programming, teachers will need ongoing mentoring and support. A cognitive apprenticeship model in which less experienced teachers practice with the guidance of those who have already implemented networked learning is likely a more effective approach to professional development. Similar consideration is warranted for pre-service teaching programs. Providing opportunities for pre-service teachers to experiment with network learning from both a teacher and learner perspective may influence the likelihood they will apply these techniques in their future classrooms.

Research suggests pre-service teachers who experience educational technology courses designed around 21st century skill sets rather than technical skills see greater value in the use of technology for learning and are less anxious about using it in the classroom (Lambert & Gong, 2010). Pre-service and in-service teacher change requires a mindset in which technology is seen as critical for effective student learning (Ertmer & Ottenbreit-Leftwich, 2010). Teacher education and professional development must address must also address knowledge of how to use technology to affect learning, confidence or self-efficacy for successfully implementing technical knowledge, pedagogical belief, and a culture in which innovation is supported (Ertmer & Ottenbreit-Leftwich, 2010).

This study, being the first of it's kind, is complex in its design and the questions it provokes. Future iterations of the instructional design are likely to change rapidly due to the plethora of emerging Web applications with learning potential. The explosion of alternative delivery methods such as online and blended learning models offers new outlets for the networked student. If, when, and how students and teachers choose to take advantage of these opportunities will define the future of networked learning and personal learning environments within the structure of school. However, the nature of personal learning is such that students with Internet access can choose to participate without that structure. Their success may depend on how well they have been prepared in the processes that support learning in an ever-changing increasingly networked world.

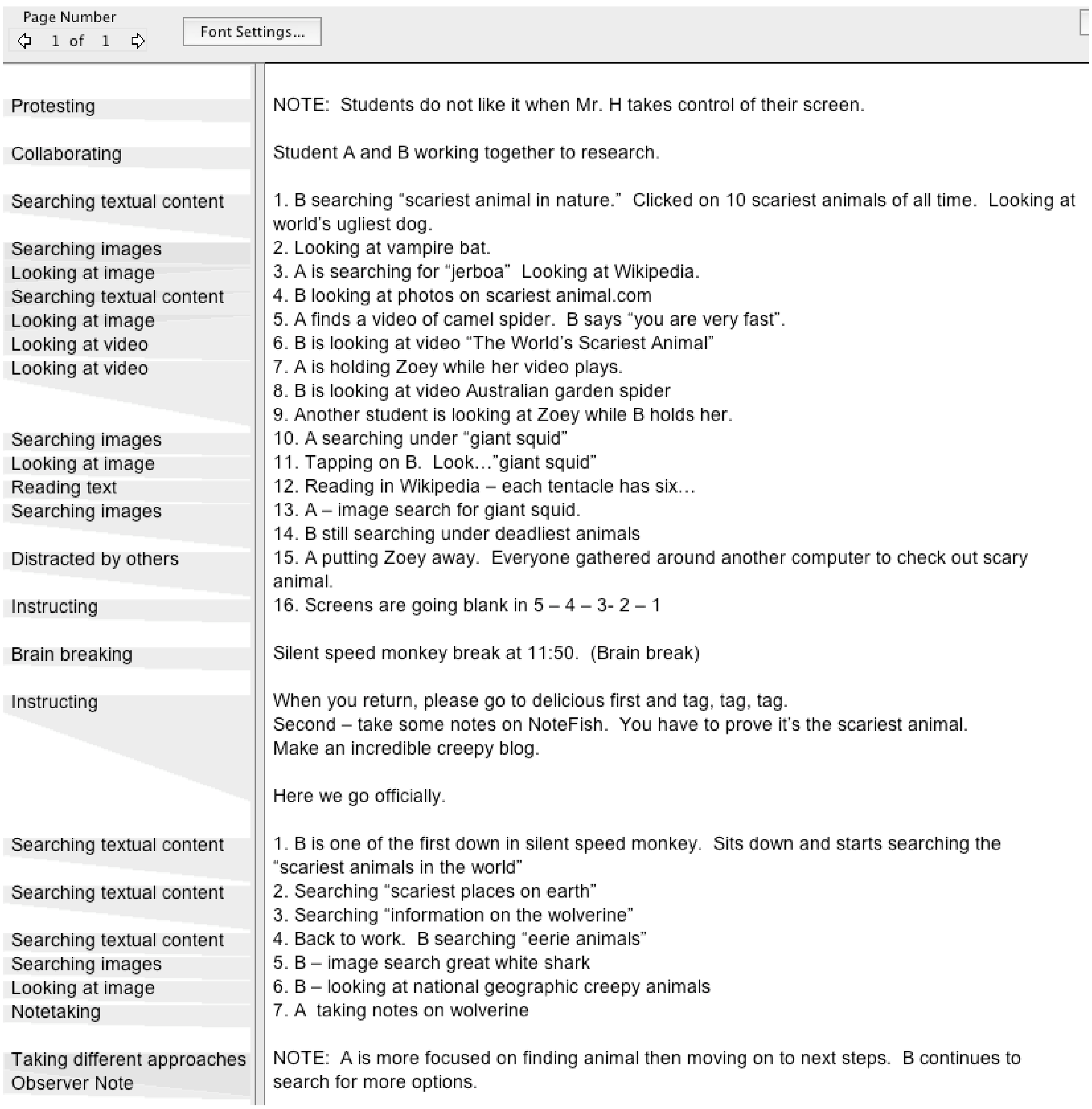
K12 schools are not doing enough to support student digital literacy and responsibility, nor are they effectively acknowledging the consequences this could have for student learning. The Internet with its learning potential and possible pitfalls is a reality of everyday communication and work life. We do our children a disservice when we do not prepare them to responsibly navigate and harness this resource for learning. It is as if K12 education policy makers are in denial that all the world's information is at the fingertips of every student. Greater access to mobile devices and wireless networks will eventually render the point of site-based filtering moot, as students will reach any content they desire directly from their smart phones. It should come as no surprise that some children will make poor choices with regard to this power and access, especially if there are no adults providing guidance. At the same time, it will grow increasingly more difficult to monitor and restrict Internet use. Greater restrictions are not the answer.

Direct instruction, communication of expectations, and community support are critical. Yet these efforts are not possible without significant changes in pre-service teacher education, professional development, administrative policies, and community awareness.

This research is significant in that it calls for the deliberate scaffolding of student construction of personal learning environments to support immediate content objectives and provide a foundation for safe, responsible life-long learning beyond the classroom. The implications for delivery, student learning, teacher professional development, and policy must be considered and addressed immediately in the best interest of future generations of learners.

APPENDIX A
CODING PROCESS EXAMPLES

All interviews and observations were imported into HyperResearch™ and coded. The column to the left in figure 7-1 displays the codes associated with the actions in the observations displayed on the right. This process was completed for three interviews, classroom observations, and individual student observations.


Page Number
1 of 1
Font Settings...

Protesting	NOTE: Students do not like it when Mr. H takes control of their screen.
Collaborating	Student A and B working together to research.
Searching textual content	1. B searching "scariest animal in nature." Clicked on 10 scariest animals of all time. Looking at world's ugliest dog.
Searching images	2. Looking at vampire bat.
Looking at image	3. A is searching for "jerboa" Looking at Wikipedia.
Searching textual content	4. B looking at photos on scariest animal.com
Looking at image	5. A finds a video of camel spider. B says "you are very fast".
Looking at video	6. B is looking at video "The World's Scariest Animal"
Looking at video	7. A is holding Zoey while her video plays.
	8. B is looking at video Australian garden spider
	9. Another student is looking at Zoey while B holds her.
Searching images	10. A searching under "giant squid"
Looking at image	11. Tapping on B. Look…"giant squid"
Reading text	12. Reading in Wikipedia – each tentacle has six…
Searching images	13. A – image search for giant squid.
	14. B still searching under deadliest animals
Distracted by others	15. A putting Zoey away. Everyone gathered around another computer to check out scary animal.
Instructing	16. Screens are going blank in 5 – 4 – 3- 2 – 1
Brain breaking	Silent speed monkey break at 11:50. (Brain break)
Instructing	When you return, please go to delicious first and tag, tag, tag. Second – take some notes on NoteFish. You have to prove it's the scariest animal. Make an incredible creepy blog. Here we go officially.
Searching textual content	1. B is one of the first down in silent speed monkey. Sits down and starts searching the "scariest animals in the world"
Searching textual content	2. Searching "scariest places on earth"
	3. Searching "information on the wolverine"
Searching textual content	4. Back to work. B searching "eerie animals"
Searching images	5. B – image search great white shark
Looking at image	6. B – looking at national geographic creepy animals
Notetaking	7. A taking notes on wolverine
Taking different approaches Observer Note	NOTE: A is more focused on finding animal then moving on to next steps. B continues to search for more options.

Figure 7-1. Coding example

A list of codes was established that could also be searched by document (Figure 7-2).

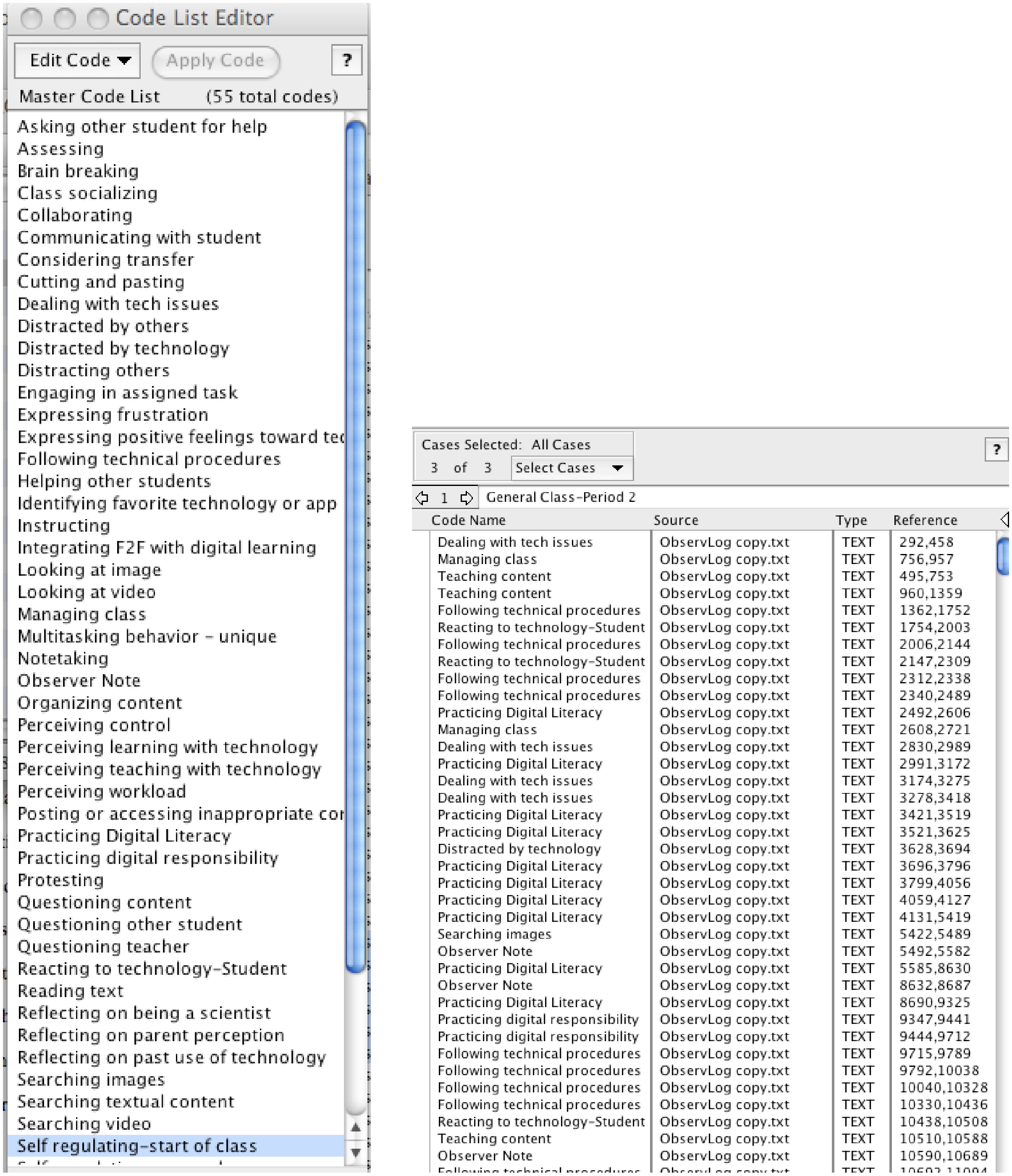


Figure 7-2. Code List Examples

After all documents were coded, the codes were analyzed to determine if overriding themes were evident. The following themes were derived from the coding process.

Learning and Practicing Digital literacy

- Following technical procedures
- Searching and viewing images
- Searching and viewing text
- Searching and viewing video
- Note taking
- Reading/comprehending online text
- Questioning Content
- Cutting and pasting

Learning and practicing digital responsibility

- Posting or accessing inappropriate content
- Using technology inappropriately

Organizing Content

- Setting up user accounts
- Adding widgets in Symbaloo
- Rearranging symbaloo page
- Setting up wall in Glogster
- Editing text in scientific report

Dealing with Technology

- Systemic
- Web application related
- Distracted by technology
- Expressing frustration
- Expressing positive feelings toward technology
- Identifying favorite technology
- Perceiving learning with technology
- Reacting to technology
- Reflecting on past use of technology

Collaborating and Socializing

- Class socializing
- Communicating with other student
- Helping other students
- Questioning other student
- Questioning teacher

Synthesizing/Creating

- Reflecting on being a scientist
- Writing on Blog
- Writing scientific report (Google Docs)
- Creating digital poster (Glogster)

- Revising with feedback from subject matter experts

Taking control and responsibility for learning

- Distracted by others
- Distracting others
- Engaging in assigned task(s)
- Multitasking
- Perceiving control
- Perceiving workload
- Self-regulating start of class
- Self-regulating resumed
- Showing excitement for learning
- Taking different approaches
- Working outside of class

Teacher processes that affect student processes

- Instructing
- Integrating F2F with digital learning
- Perceiving teaching with technology
- Teacher commenting on project
- Teaching Content

APPENDIX B
STUDENT AND TEACHER INTERVIEW QUESTIONS

Semi-Structured Interview Draft
Networked Student Project
W. Drexler Revised 10/27/09

Teacher Interview:
Relative to student processes

1. Tell me about the processes students go through to prepare for networked learning.

2. How do these processes change as students become more comfortable in this learning environment?

3. In what ways did you adjust your teaching practice to support the process of networked learning? How did these changes affect student processes?

4. What student characteristics are most conducive to networked learning?

5. What was the most difficult aspect(s) of the project for the students learning in this environment, for you as a teacher? Explain.

6. What benefits are there for students who construct personal learning environments?

7. How has student learning of the scientific process changed from previous years as a result of this project? How do you know?

8. What differences have you seen between high achieving and struggling students?

9. Describe how students responded to some of the technical difficulties that hindered students in this project.

10. How can technical difficulties be mediated in future projects?

Now I'm going to ask you some questions about your teaching practice and how others might apply a networked learning approach.

1. If you were to design a networked learning project from scratch, what applications would be most important? Why? Which apps would you discard? Why?

2. How do you assess this learning process? In what ways might you assess in the future?

3. What characteristics do you feel are important for a teacher who wants to facilitate a networked learning project?

4. What percentage of your colleagues would be ready to take on a networked learning project?

5. What would you do differently in your next networked learning project?

6. Is there anything else you would like to share about this project?

<u>Students:</u>

I'm going to start with a couple questions about your past years in school

1. Tell me about your science class last year. What was it like to learn in that class?

2. Tell me about how you've used computers for learning over your years in school.

The next set of questions is about the networked learning project in Mr. H's class.

1. Tell me about your experience with the laptop computers and networked learning in your science class this year.

2. How is this class different than your other classes?

3. How does your learning in this class compare to other classes?

4. How is the behavior in this class compared to your other classes?

5. What is the first thing you do when you come into Mr. H's class?

6. How do you look at technology in a different way after participating in Mr. H's class?

7. What is the hardest part of networked learning?

8. What were the biggest distractions for you as you used the Internet to research and learn?

9. Tell me about some of the technical difficulties you had in this project.

10. What is your favorite part of learning in this way?

11. What applications were your favorite, and how would you use them in the future?

12. How did you use the Symbaloo page for your project?

13. How will you use your Symbaloo account after this project is over?

14. How is it different to take notes with EverNote rather than pencil and paper? (Which do you prefer?)

15. What did you think about the blog? How will you use it in the future?

16. How about your delicious bookmarking account?

17. Give me an example of how you might use this way of learning for one of your other subjects.

18. What should students know before creating their own personal learning environment?

19. What advice would you give to other students who do this kind of learning project?

20. What advice would you give teachers?

21. How did you interact with others differently in this project than you would in another science class?

22. Is there anything else you would like to share with me about this project?

Now I'm going to ask you some questions about your research.

1. What does it mean to think like a scientist?

2. What was your research topic?

3. What answers did you find?

4. How can you tell if the information on a website is correct?

5. If you had to learn about cells without the help of Mr. Hollinger, what would you do?

The next questions are about using technology outside of class.

1. If you have a computer at home, tell me some of the things you do with it.

2. If you have a cell phone, what are some of the ways you use it?

3. What do you do when you come across inappropriate content on the Internet?
4. How is using a computer at school different from using it at home?

APPENDIX C
RELEVANT EDUCATIONAL STANDARDS

Next Generation Sunshine State Standards (NGSSS) – Science
SC.7.N.1.1 Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. *Cognitive Complexity/Depth of Knowledge Rating:* High SC.7.N.1.3 Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation. *Cognitive Complexity/Depth of Knowledge Rating:* Moderate SC.7.N.1.7 Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community. *Cognitive Complexity/Depth of Knowledge Rating:* Moderate SC.8.N.2.2 Discuss what characterizes science and its methods. *Cognitive Complexity/Depth of Knowledge Rating:* Moderate
National Science Education Standards (NSES)
Content Standard A-Science as Inquiry Students should develop abilities necessary to do scientific inquiry and understandings about scientific inquiry in an effort to recognize the relationship between explanation and evidence. Content Standard C-Life Science Grades 5-8 Students should develop understanding of structure and function in living systems, regulation and behavior, diversity and adaptations of organisms
International Society for Technology in Education National Educational Technology Standards for Students NETS-S
1a: Students apply existing knowledge to generate new ideas, products, or processes. 1b: Students create original works as a means of personal or group expression. 2a: Students interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media. 2b: Students communicate information and ideas effectively to multiple audiences using a variety of media and formats. 3a: Students plan strategies to guide inquiry. 3b: Students locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. 3c: Students evaluate and select information sources and digital tools based on the appropriateness to specific tasks. 3d: Students process data and report results.

4a: Students identify and define authentic problems and significant questions for investigation.

4b**:** Students plan and manage activities to develop a solution or complete a project.

5b**:** Students exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.

5c: Students demonstrate personal responsibility for lifelong learning.

6a: Students understand and use technology systems.

6b**:** Students select and use applications effectively and productively.

6c: Students troubleshoot systems and applications.

APPENDIX D
DAILY AGENDA ACTIVITIES POSTED ON TEACHER BLOG

August 25 – November 2, 2009

Note: Relevant standards are listed under agenda activities for each day.

August 24, 2009
First day of school. Preparation activities not yet posted on blog.

- Administer Constructivist Learning Environment Survey (CLES)
- Discuss class procedures

August 25, 2009

- What is science
- YouTube Videos: Venomous Spit vs Six Levels of a Shock Collar
- Eyes closed heads down think. Are either of these considered science?
- Incorporate Kagan Structures into class activities
- What is the difference between rules and procedures?
- Set up computers and logins
- Look at Pacific Northwest Tree Octopus Website (http://zapatopi.net/treeoctopus.html)
- Is it real? If it's on the Internet it must be real, right?

(NGSSS: SC.7.N.1.3, SC.7.N.1.7, SC.8.N.2.2; NSES: Content Standard A; NETS-S: 3c, 6a, 6b)

August 27, 2009

- Research Northwest Pacific Tree Octopus Website
- Record notes about this life form
- Facts are good, what about question? What questions do you have about this animal?
- Conduct additional Internet research to support your position that the tree octopus is real or not real.
- How do you know when you find conduct research that something is real or not real?

(NGSSS: SC.7.N.1.1, SC.7.N.1.7, SC.8.N.2.2; NSES: Content Standard A; NETS-S: 3b, 4a, 6a, 6b)

September 1, 2009

- Becoming the paperless, advanced classroom of tomorrow
- Register for Symbaloo account
- Register for NoteFish (ultimately switched to EverNote when NoteFish was no longer supported by FireFox software upgrade)
- Introduce class pets – Use NoteFish to collect research about chameleons
- Share findings with class

(NGSSS: SC.7.N.1.1, SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 6a, 6b)

September 3, 2009

- Collect student email accounts to set up teacher distribution list for each class
- Using Steve the Bearded Dragon to learn about technology
- Set up NoteFish page titled “What Scientists Do”
- Use online whiteboard with class to collect ideas about what scientists do
- Appropriate language when using computers professionally versus with friends socially
- Set up social bookmarking account on Delicious

(NGSSS: SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 2a, 3a, 3b, 3c, 3d, 4a, 5b, 6a, 6b)

September 8, 2009

- First 10 minutes of class conducting personal business such as checking email, organizing content
- YouTube Video: Slip and Slide (person flies through the air and lands in a small pool of water about 100 yards away) Is it real? How could it be scientifically tested?
- Guidelines for using YouTube in class (Access only videos directed by teacher, disregard all comments – don’t even read them)
- Set up student blogs

(NGSSS: SC.7.N.1.3, SC.7.N.1.7, SC.8.N.2.2; NSES: Content Standard A; NETS-S: 3c, 4a, 5c, 6a, 6b)

September 10-11, 2009 (First official agenda posted on PK Science Agenda Blog)

1. log in to all applications - blogger, notefish, symbaloo, delicious, email, google documents
2. Today you will be graded on the following things. Look at the job and look at the points. Do your best and have fun.
    - Symbaloo (18 pts - 3pts per button) you should have buttons for the following: your blog, the science agenda (this blog), delicious, notefish, your email, google docs
    - Blogger (50 points) a nice post about your topic. Well written and organized : 35 points (C) - you have a nice well written blog about your topic, 40 points (B) - You have a well written blog and included some pictures that help explain your topic, 50 points (A) - you have a nice blog with pictures and bonus material such as video, gadgetts or other creative ideas
    - Delicious (20 points) you can show me at least 5 websites on your topic that you have tagged properly under your sign-in
    - email (10 points) - you are able to receive my emails and have many class contacts
    - Google Documents (10 points) - you have a google documents account
    - Notefish - (30 points) - you have more than one section in your notes with the websites you got your information from posted

Make sure you are talking to your partner and working together. It might help to "play teacher" and grade each other before I make it around.
(NGSSS: SC.7.N.1.1; NETS-S: 3b, 5b, 6a, 6b)

September 14, 2009

Download Flash plugin if you cannot see this video
YouTube Video – Beaver Lumberjacks
Download all of the stuff - keep pressing yes, I agree, download now and so on

You have some choices today**:**
Finish the assignments from Thursday and Friday - Let me know when you are ready for your grades: I believe grades should be your choice.

If you are happy with your progress from last week, those of you that are certified for axoltols can catch your axolotl and meet me for a session on how to feed your axolotl - this information will of course be in your notes and today's blog. If you finish this work, go on to #3. Axolotl people MUST join this site: http://www.caudata.org

If you are happy with your grades and are not certified for the axolotl, do this:

- Answer this question: What is the scientific method? Use notefish first to gather information relating to this question
- Use delicious to mark 5 or more sites under the tag "pkyscience" and "scientificmethod"
- Start preparing a good document (presentation) using Google docs, or using your blog to describe exactly what this means.

(NGSSS: SC.7.N.1.1, SC.7.N.1.3, SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 1a, 3b, 4a, 6a, 6b)

September 15-16, 2009

Warning – Very creepy and kind of gross.
You Tube Videos: Cockroach Infestation and Underwater Creature Camouflage

1. Turn in permission forms
2. Log on computers to https://dl.getdropbox.com/u/47082/Student.msi
3. Log on to the following – symbaloo, delicious, notefish, blogger
4. Rename your Symbaloo page PKY(your name and last initial) example: pkyjoef
5. Use a grade sheet and go through each of these tabs with your shoulder partner
6. Switch sides and look at your partners work and discuss each other's grades
7. Give help as needed so that both of you are up to date.
8. If you finish – you and your partner do a web quest together to find the scariest real animal on Earth – you will have to agree with each other- both of you should have notes in your NoteFish and tag these sites with Delicious
9. Game Break
10. Go back to #8 in this agenda – make your blog to explain why your animal is scariest!

(NGSSS: SC.7.N.1.1, SC.7.N.1.7; NSES: Content Standard A and C; NETS-S: 2a, 3a, 3c, 3d, 6a, 6b)

September 17-18, 2009

Cast your vote for scariest animal if you are a cricket

1. Log on to all applications and download https://dl.getdropbox.com/u/47082/Student.msi
2. Watch the Biomes video from http://www.thewildclassroom.com/biomes/speciesprofile/species/amblypigid.html
3. Then answer these questions on notefish:
    - Rate this creature in terms of how dangerous it is (10=very dangerous, 1=harmless)
    - Why do you think the Harry Potter movie used this creature instead of something else like a bunny?
    - What group of animals is this similar to?

1. Make a new NoteFish section titled "vocabulary" put these words in it : empirical, nocturnal, diurnal, arboreal, terrestrial, omnivore, insectivore, carnivore, herbivore - define them with words or pictures (your choice)
2. You and your shoulder partner agree on the worlds scariest animal
3. Partner A makes up 3 questions about the animal (put on Notefish)
4. Partner B makes up 3 questions about the animal (Put on notefish)
5. Partner B closes computer and helps partner A put up their blog information
6. All Class vote on scariest animal according to blogs only

(NGSSS: SC.7.N.1.1, SC.7.N.1.7; NSES: Content Standard A and C; NETS-S: 1a, 1b, 2a, 2b, 3a, 3b, 3c, 4b, 5b, 6a, 6b)

September 21, 2009

Hey, I bet some of you have these around your house, too.

YouTube Video: Antlion Death Trap

1. Check to make sure you are on the LAN school so I can supervise your work, if not, go to yesterday's agenda and download the link.
2. Add these vocabulary words to your vocabulary page under NoteFish : Law, Theory, Hypothesis
3. Finish blog on your vote for worlds scariest creature.
   If you finish early, you should
    - Finish vocabulary words from today and last class (look below if you missed these)
    - Complete certifications for you class animals of choice

(NETS-S: 6a, 6b)

September 23-24, 2009

1. Give your partner one compliment
2. Clean-up symbaloo time (10 minutes)
3. Pocket Tanks-a-Rama!!
4. Download the pocket tanks game from http://www.blitwise.com/downloads.html

5. Practice playing against the computer for a few minutes
6. Learning the Scientific Method or (scooby got hurt eating roasted chicken)
7. Play pocket tanks with your shoulder partner
   - State the Problem - what is your essential question (has to be a question)
   - Gather information - state what you know about the subject
   - Hypothesis - What is your guess (angle or power is best. . .or both?)
   - Experiment - What are your steps- this is a challenge to be as accurate as possible in your steps Record and Analyze - Using google spreadsheet, keep a close record of each move - this is called data
   - Conclusion - After looking at your results, and making graphs perhaps, what do you conclude about your hypothesis? Is further testing needed? Are you using your actual results to discuss your argument?

Here is a sample spreadsheet!
http://spreadsheets.google.com/pub?key=t4fQLdYc0G8ejolWvny
(NGSSS: SC.7.N.1.1, SC.7.N.1.3, SC.8.N.2.2; NSES: Content Standard A; NETS-S: 2a, 3b, 4a, 4b, 6b, 6c)

September 28, 2009
Snakes loose in Florida - read this -
http://www.gainesville.com/article/20090922/ARTICLES/909219987

Monday work day - here is what you should work on in order of what is most important

1. Write your scientific paper on pocket tanks (do your spreadsheet first if you have not done this) here is an example
   http://docs.google.com/View?id=dc2j9tpq_159cb5rpjf9
2. Check your Symbaloo site and make sure all buttons are there and working, this should be checked off by a partner or another student
3. Finish all vocabulary words and make sure you have the steps of the scientific process in your notes
4. Make sure you and your partner have a blog site with your vote for worlds scariest animal!

(NGSSS: SC.7.N.1.1, SC.7.N.1.3, SC.8.N.2.2; NSES: Content Standard A; NETS-S: 1b, 3d, 6b, 6c)

September 29-30, 2009
Finish scientific paper (scooby got hurt eating roasted chicken) here is ALMOST A work!
http://docs.google.com/Doc?docid=0AWL5-KjIWnFYZGdocmNrZHJfMTRmYjk2bWdjZw&hl=en

1. Have at least 2 students read through your paper
   Make corrections as suggested by your peers
2. Post your finished work as a button on your Symbaloo page
3. Make a short blog about what you do when you are going to write a scientific paper
4. Post your paper as a link on today's blog.

5. Post a link to at least 2 of your friend's papers. (most likely the ones you read.
6. Finish vocabulary on NoteFish
7. Work on certifications (5 delicious marks, a NoteFish page, and a nice blog)
8. Fill out Symbaloo form (I will help with this) http://spreadsheets.google.com/viewform?formkey=dG9Cbzg3RF9FOElIa3hPclpFR09ja2c6MA

(NGSSS: SC.7.N.1.1, SC.7.N.1.3, SC.8.N.2.2; NSES: Content Standard A; NETS-S: 1a, 1b, 2a, 2b, 3b, 3c, 4a, 4b, 5b, 6b, 6c)

October 1, 2009

YouTube Video: Giant King Cobra

1. Finish the agenda items from last class (scroll down below until you see the date from last class) - there is some other stuff to do after you finish your paper
2. Vote on worlds scariest creature blogs - only the completed blogs
3. Intro to "Venomous and Poisonous Creatures!" (I will blank you out about half way through class)
4. Click here to get started! http://docs.google.com/View?id=dc2j9tpq_165hp7bzzfq
5. Add all good Internet sites to your delicious account (you should have tagged many more, probably 10 or more- find the fun sites!)

(NSES: Content Standard C; NETS-S: 3b, 3c, 6b, 6c)

October 5, 2009

1. Go to your symbaloo page

- Click on your page name
- Click "share it"
- Copy the website address it gives you
- Complete the form and paste your website here http://spreadsheets.google.com/viewform?formkey=dG9Cbzg3RF9FOElIa3hPclpFR09ja2c6MA

2. The Truth about Tarantulas - venomous creatures!! - Words of the day (put in your notes) venomous, poisonous, behavioral adaptations, physical adaptations, old world, new world
3. Post a link to your scientific paper (you can work on this if you are not done. I will be coming around to put in official grades)
4. Get started on your deadly creature requirements here http://docs.google.com/View?id=dc2j9tpq_165hp7bzzfq
5. Get certified for class animals.

(NGSSS: SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 3b, 3c, 6b, 6c)

October 6-7, 2009

Here is a creature that I can't decide if it is poisonous or venomous. What do you think? (Discovery Education Video)

1. Go to evernote.com and sign up for an account (your same passwords and usernames so you DON'T FORGET!)
2. Go to google docs
3. Choose "new" and choose "presentation"

4. Make 4 slides and title them "behavioral adaptations", "physical adaptations", "venomous", and "poisonous" (20 points) - here is a starting example from Jordyn http://docs.google.com/present/edit?id=0ASwDmCH3T3ttZGQ2ODRyNTlfMmdoa2M4Nmht&hl=en
   Use pictures, images, diagrams or words to help show what the words mean for each slide
5. Make a short blog about these vocabulary words and provide a link to your presentation (10 points)
6. Have your scientific paper peer reviewed by 2 students (email them and have them email back suggestions) (whole paper 100 points)
7. Post your paper as a button on symbaloo (10 points)
8. Make a blog about the scientific process (Scooby got hurt eating roasted chicken) and post a link to your work (10 points)
9. Make a list of 20 poisonous and venomous creatures (on evernote) (10 points)
10. Label which animals are "species" and not a larger group (we will go over how to do this if you are confused) (10 points)
11. Choose 5 species from your list and make 2 essential questions for each - these are questions that ask about something important about your species - (10 points)

(NGSSS: SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 1a, 1b, 2a, 2b, 3a, 3b, 3c, 4b, 6b, 6c)

October 8-9, 2009

Here is a really venomous creature. Wow!!!
YouTube Video: Box Jellyfish – Chironex Fleckeri

1. Finish your slideshow (using google docs) - (20 pts) - here is an example of almost complete 'A' work from Marquis - http://docs.google.com/present/edit?id=0ASwDmCH3T3ttZGQ2ODRyNTlfMmdoa2M4Nmht&hl=en - Check yesterdays blog for more details
2. Use evernote to make a list of 20 poisonous or venomous creatures. (10 points)
3. Label which examples you put were actually one species or it they are in fact a group of animals (10 points)
4. Choose 5 species from your list and make 2 essential questions for each one (an essential question asks for important information that must be explained, not just answered.) (20 points)
5. If finished, work on your scientific paper or getting certified for all class specimens - that's right, there is no "done" in this class, only "doing well!"

(NGSSS: SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 1a, 1b, 2a, 2b, 3a, 3b, 3c, 4b, 6b, 6c)

October 13-14, 2009

YouTube Videos: Kingdom Song (7th and 8th grade), Cuban Tree Frog
Cuban Tree Frogs on the Rise

1. Read this and then tag it into your Ever note http://www.gainesville.com/article/20070613/LOCAL/706130327

2. Make a list of physical adaptations regarding your Cuban tree frog, Here is a helpful link: http://www.wec.ufl.edu/extension/wildlife_info/frogstoads/osteopilus_septentrionalis.php
3. KID vs FROG - you will need some paper for this one as we can not take the computers outside! Here is a sample spreadsheet. http://spreadsheets.google.com/pub?key=t5Z28s2tAaR7Qoq2QS2PLrQ&output=html
4. Label the Kingdom, Phylum, Class, Order, Family, Genus and species of the frog and try to tell what each group means. (For example, Animal kingdom - living things that are made of many cells, eat and move)
5. Make a blog about a possible to solution on how to get rid of Cuban Tree frogs from your house.
6. Make a shorter version of a scientific paper including your spreadsheet and the problem is labeled - Who is a better jumper, the human or Cuban tree frog? (this question is State the Problem) - ****Try using video!!****

(NGSSS: SC.7.N.1.1, SC.7.N.1.3, SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 1b, 6b, 6c)

October 15, 2009

YouTube Video: The Stankies: Mr. Hollinger's 3rd Period, 7th Grade Kingdom Project Song

Scientific Paper - The Pocket Tanks Paper (post on blog)

1. Blog on the steps of the scientific process and a link to your work.
2. List of 20 poisonous or venomous animals (evernote)
3. Label which animals are species and which are groups from your list
4. Pick 5 and put down 2 questions for each one
5. Write frog vs human scientific paper (problem = Who jumps better, a frog or human)
6. Blog on how to get rid of Cuban tree frogs (your own idea, even if it is crazy. Have fun, use pictures, diagrams, whatever!)

   Bonus Ideas:

   - Video for frog vs human
   - Start research on your venomous or poisonous "major"

Here is the first period version of the Kingdom song
http://www.youtube.com/watch?v=_i4rLM_GLFU
(NSES: Content Standard C; NETS-S: 1b, 2b, 3d, 6b, 6c)

October 19-21, 2009

YouTube Video: Mr. H Glogster

1. Watch video about Glogster
2. I will interrupt you to start something new and fun
3. Sign in to Glogster with the username and password I give you

4. Choose **one of these topics** - **1.** behavioral vs physical adaptations, **2.** old world vs new world tarantulas, **3.** poisonous vs venomous, **4.** species vs groups of living things **5.** A deadly creature from your list. It should have the following:
    - **TitleAuthor** - First name/Last initial
    - **One paragraph** of original text. (Must be in your words, not copied from website.)
    - **Audio** that gives a scientific description of animal (or whatever - think creepy)
    - **Two images** with links to the original photograph given under the image.
    - One appropriate **video** if you can find one.
    - **Neatly** designed and easily understood by visitors

Here is Amanda's from 2nd period :http://pkyamandab.glogster.com/oldworldnewworld/

I will grade the following on Friday. If you are not done, you will not get a grade.
- Scientific Paper on Pocket Tanks (100pts)
- Scientific Paper on Cuban Tree frogs (100pts)
- Evernote notes and deadly creature list (30 pts)
- Slide show on vocabulary words (behavioral adaptations, venomous etc) (50 pts)
- Glogster from Today (50 pts)

Here are some **SWEET** glogs that some other people made:
http://rialove.glogster.com/Foodchain/
http://katemena.glogster.com/water-matters/
http://suziq56.glogster.com/glog-340-655/
http://aaa999.glogster.com/AugustusIII/
http://sydneyk.glogster.com/anne-boleyn/
http://josephca.glogster.com/Cardinal-Richelieu/
(NGSSS: SC.7.N.1.1, SC.8.N.2.2; NSES: Content Standard A and C; NETS-S: 1a, 1b, 2b, 3a, 3b, 3c, 3d, 4b, 5c, 6a, 6b, 6c)

October 22-23, 2009
YouTube Video: Japanese Giant Salamander

1. Go to this link and post the information into your evernote page.
   http://docs.google.com/View?id=dc2j9tpq_173f4jvfqhc
2. Class meeting - have your past work available for grading when I can come by
3. Goal 1 (30 minutes)
    - Sign into Glogster
    - Pick one venomous or poisonous creature from your evernote list
    - Give you Glogster a title
    - Post 2 pictures

    - Write down the 5 most important things about your creature (your own words)
4. Game break
5. Goal 2 (30 minutes)
    - Post a relevant video on your creature
    - List the top 3 best websites that relate to your topic (these should be tagged in delicious)
    - Write down 3 important questions you have that you could not answer (your own words)
    - Compose an email (DO NOT MAIL YET) to a real scientist that studies your creature to see if they would be willing to look at your Glogster for scientific validity (hard words huh)
6. Class checkout and Glogster sharing
7. Things to do if you finish early
    - Make a Glogster about the class animal of your choice to get certified
    - Finish your scientific paper on tree frogs vs humans (remember the 6 steps)

(NGSSS: SC.7.N.1.7; NSES: Content Standard C; NETS-S: 1b, 2b, 6a, 6b, 6c)

October 27-28, 2009

1. Warm-up (10 minutes) open google docs, evernote, glogster, blogger
2. Class meeting and set goals for the day (a work day)
3. Session One (goal 1) (30 minutes)
    - Pocket Tanks paper
    - Slide show on vocabulary
    - Glogster on venomous or poisonous creature

Brain break - (10 minutes) mix pair share

4. Session 2 (30 minutes) goals
    - Finish the above things
    - Write email to scientist to ask them to view your work
    - Daily Scientific Paper on Cuban tree frogs
5. Last 10 minutes - update blog - what was accomplished, what is still to be done, what successes did you have?
6. Here is list of work that is to be done and will be graded (only if it is done)
    - Scientific paper - pocket tanks
    - Scientific paper - Cuban tree frogs vs humans
    - Slide show on vocabulary words
    - Glogster on deadly creature
    - Evernote page
    - Email composition and location of scientist to look at your Glogster (do not email yet)
    - Blog (daily now)

(NETS-S: 3b, 6a, 6b, 6c)

October 29, 2009 Final Work Day First Nine Weeks

Here is an 'A' work glog! http://s010.mrhollingerscience.edu.glogster.com/glog-7444-6319/
Also, more here: http://s018.mrhollingerscience.edu.glogster.com/Rattlesnakes/

1. Warm-up 10 minutes
   Class meeting and Goal setting (5 min)
   Work session 1 (30 minutes)
   Brain Break according to board (10 min)
   Work session 2 (30 min)
   Blog time (10 minutes)

2. Here are some things you could be working on today.

   - Pocket Tanks scientific paper
   - Cuban tree frog scientific paper (fill out spreadsheet first, the part where it asks how many times the body length the frog jumped, a bit of math)
   - Vocabulary slide show
   - Glogster on poisonous or venomous animal
   - List of 3 scientific contacts to send email to (goes in Evernote)
   - Your email composition asking for the scientist to look and assess your Glogster (if you have a good one, we can use it as a model for other students)
   - Any animal certifications.

Grade sheets: http://docs.google.com/View?id=dc2j9tpq_174dt9b6kgm

(NETS-S: 3b, 6a, 6b, 6c)

November 2, 2009

1. Take this survey first:
   http://www.surveymonkey.com/s.aspx?sm=DgGLOpbHTgW1eCNnBwFJ_2bg_3d_3d
   (Re-administering the Constructivist Learning Environment Survey (CLES)
2. You will practice your email to a scientist
3. Your shoulder partner is the "scientist"
4. Write an email to your scientist with a link to your work. You should have the following information
   - Your first name (no last names)
   - A one sentence description of who you are (grade level) and what school you attend
   - A one sentence description of your project and how they can get a hold of your teacher (Mr. H)
   - A polite request for them to view your project
   - 2-3 questions that you can ask them that will make your project better
   - A working link to your project
   - A thank you and sincerely line

5. You will get an email from your partner and look for each of these things including spelling and grammar and check their email. Your partner will check yours
6. The email will then be sent to Mr. Cunningham for approval (gcunningham@pky.ufl.edu)

Here is a short example:
Hello, My name is Eliana. I am in 7th grade, currently attending PKY. I am doing a project in my science class, and I would appreciate your opinion on the following:
- Is the information on this accurate?- Am I missing any information?- Do you find the information easy to understand and appealing to read?
Please click here to view my project: "Put in Glogster link"

Eliana
Teacher: Mr. H

(NGSSS: SC.7.N.1.3, SC.7.N.1.7; NSES: Content Standard A and C; NETS-S: 2a, 2b, 3c, 5b, 5c, 6a, 6b, 6c)

APPENDIX E
CONSTRUCTIVIST LEARNING ENVIRONMENT SURVEY

What happens in my science classroom?

• Student form •

DIRECTIONS

1. Purpose of the Questionnaire
This questionnaire asks you to describe important aspects of the science classroom which you are in right now. There are no right or wrong answers. This is not a test and your answers will not affect your assessment. Your opinion is what is wanted. Your answers will enable us to improve future science classes.

2. How to Answer Each Question
On the next few pages you will find 25 sentences. For each sentence, circle only one number corresponding to your answer. For example:

		Almost Always	Often	Some-times	Seldom	Almost Never
In this class . . .						
8	The teacher asks me questions.	5	4	3	2	1

- If you think this teacher *almost always* asks you questions, circle the 5.
- If you think this teacher *almost never* asks you questions, circle the 1.
- Or you can choose the number 2, 3 or 4 if one of these seems like a more accurate answer.

3. How to Change Your Answer
If you want to change your answer, cross it out and circle a new number, For example:

8	The teacher asks me questions.			3	2	1

4. Course Information
Please provide information in the box below. Please be assured that your answers to this questionnaire will be treated confidentially.

a. Name:	b. School:
c. Grade/Year-level:	d. Sex: male /female (please circle one)

5. Completing the Questionnaire
Now turn the page and please give an answer for every question.

Learning about the world		Almost Always	Often	Some-times	Seldom	Almost Never
In this class . . .						
1	I learn about the world outside of school.	5	4	3	2	1
2	My new learning starts with problems about the world outside of school.	5	4	3	2	1
3	I learn how science can be part of my out-of-school life.	5	4	3	2	1
In this class . . .						
4	I get a better understanding of the world outside of school.	5	4	3	2	1
5	I learn interesting things about the world outside of school.	5	4	3	2	1
Learning about science		Almost Always	Often	Some-times	Seldom	Almost Never
In this class . . .						
6	I learn that science has changed over time.	5	4	3	2	1
7	I learn that science is influenced by people's values and opinions.	5	4	3	2	1
In this class . . .						
8	I learn about the different sciences used by people in other cultures.	5	4	3	2	1
9	I learn that modern science is different from the science of long ago.	5	4	3	2	1
10	I learn that science involves inventing theories.	5	4	3	2	1
Learning to speak out		Almost Always	Often	Some-times	Seldom	Almost Never
In this class . . .						
11	It's OK for me to ask the teacher "why do I have to learn this?"	5	4	3	2	1
12	It's OK for me to question the way I'm being taught.	5	4	3	2	1
13	It's OK for me to complain about activities that are confusing.	5	4	3	2	1
In this class . . .						
14	It's OK for me to complain about anything that prevents me from learning.	5	4	3	2	1
15	It's OK for me to express my opinion.	5	4	3	2	1

Learning to learn	Almost Always	Often	Some-times	Seldom	Almost Never
In this class . . .					
16 I help the teacher to plan what I'm going to learn.	5	4	3	2	1
17 I help the teacher to decide how well I am learning.	5	4	3	2	1
18 I help the teacher to decide which activities are best for me.	5	4	3	2	1
In this class . . .					
19 I help the teacher to decide how much time I spend on activities.	5	4	3	2	1
20 I help the teacher to decide which activities I do.	5	4	3	2	1
Learning to communicate	Almost Always	Often	Some-times	Seldom	Almost Never
In this class . . .					
21 I get the chance to talk to other students.	5	4	3	2	1
22 I talk with other students about how to solve problems.	5	4	3	2	1
23 I explain my ideas to other students.	5	4	3	2	1
In this class . . .					
24 I ask other students to explain their ideas.	5	4	3	2	1
25 Other students listen carefully to my ideas.	5	4	3	2	1
	Almost Always	Often	Some-times	Seldom	Almost Never

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BIOGRAPHICAL SKETCH

Wendy Drexler has taught elementary, middle, and high school students in public and private schools in the United States. Her seventh-grade gifted students developed the first Website for the city of Safety Harbor, Florida. Her third grade class created a comprehensive site to raise awareness and funds for children in Darfur. Wendy developed the first blended online learning courses for high school students at Shorecrest Preparatory School. As an eLearning project manager for IBM and a senior eLearning manager for AT&T, she designed and implemented of the first Web-based training modules for the Network Sales Divisions. She is passionate about authentic student learning and autonomy. While conducting the research for this dissertation, she also facilitated a professional learning community of practice in which her graduate students used API widgets to organize and share research. In addition to personal learning environments, her research interests include collaborative blogging, professional communities of practice, integrating technology with service learning, and best practices in online learning.