

# IT'S TOO LATE TO READ THIS PAPER

## Literacy in the Information Age

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### INTRODUCTION

Are you old enough to remember the very first black and white television shows? Maybe you have had the chance to look at some old clips from the 1950's. When television came out many people saw it as a replacement for the radio. A television was a radio that let you see the actors and the location of the broadcast. Many of the earliest TV shows were very much like radio shows with costumes and props. Those people who conceived of television had little idea what could really be done with a visual medium. As time passed television producers have learned to manipulate the visual aspect of television for entertainment (and advertising). Now the first TV shows are slow moving and boring to watch.

Internet technology is in its infancy. Our minds cannot really conceive what effect it will have on us and what role it will play in our lives. Technology is often seen as taking the role of a book or television. But it is different than both of them. The Internet is unique and uncontrollable. What effect will it have on literacy instruction? Does it spell the end for books? Can it be managed in an educational setting and how? What are the leaders in literacy education saying about it? This paper attempts to look at these issues and to offer some practical solutions to teachers who are seeking to integrate technology into their literacy instruction.

### THE FUTURE OF THE BOOK

Experts on literacy and technology agree that books will not be replaced by technology. (Leu 1999). Most people do not like to read long passages on the screen. According to DevHead, an electronic

magazine for web page developers, (<http://www.zdnet.com/devhead/alertbox/980726.html>) people read about 25% slower from computer screens than print. The resolution of the average monitor on a computer is just not fine enough to display text that is clear and easy on the eye. Other aspects of reading books are also important to consider. The physical aspects of holding a book and turning pages are associated with the pleasures of reading. Looking at the titles of books on a shelf that have different sizes and colors is not the same as looking at a list of titles on a computer screen. These issues need to be taken seriously by anyone seeking to create an electronic book.

There are several entrepreneurs who have come out with versions of electronic books. Several of them are on the market and there will be others to follow. These are electronic reading machines that are designed to be as much like a paper book as possible. They are about the size of a standard piece of paper. So far, electronic books resemble a popular child's toy, the etch-a-sketch. The screen is designed to show a white background and black lettering. To turn pages, annotate text, search and download new material you can use buttons or the screen also responds to touch. Digital versions of magazines and books can be stored in the reader. The designers have been very careful about the backlighting to ensure pleasant reading. The motivation for their creation was primarily an entrepreneurial one. The inventors had a problem and created something that would solve it and hopefully make them rich at the same time. The founders of two of the companies that make these books both describe situations in which they wanted to use books, but it was inconvenient or impossible. One inventor did a lot of airline travel. Books are heavy and carry on luggage is limited. Businessmen and academics especially feel the waste of time when they have finished with the books and work they are carrying and have no more resources. An e-book could store the full contents of close to a dozen books at a time. The other originator of an electronic reader enjoyed doing his work in a coffee shop, but could not easily bring all of the texts and materials that he needed and spread them out. An electronic book stores working documents as well as business publications and is easy to transport. (Silberman 1998)

One company, SoftBook Press has created an e-book that is aimed at the business market. A customer would purchase a “reader” and a monthly service plan. The built in modem allows customers to connect online to the company and download purchases at any time. The material offered by SoftBook Press is oriented to a business and professional audience. The SoftBook is currently offering two purchase options. A one time payment of \$599.95, or a one time payment of \$299.95 plus the purchase of a \$19.95 per month content package for 24 months which will allow you to connect to their site and download literature or other reading materials. It can hold up to 1, 500 pages and the memory is expandable to about 150,000. (<http://www.softbook.com>)

The RocketBook is aimed at the consumer market and works a bit differently. A customer purchases the RocketBook, which comes preloaded with some general interest material and instructions on how to use it. The RocketBook requires connection to a personal computer in order to access Barnes and Noble for downloading of books. There is a per book charge rather than a monthly fee. On their web site a list of books currently available is posted. The Rocketbook is advertised for \$349. It comes with software for your personal computer called Rocket Librarian that can store books you download that you don’t want to keep on the Rocketbook. It can store up to a dozen books depending on size. One book only takes about 200k of space, so you could hold close to 2000 books on a 2 GB hard drive and download a dozed at a time that you wanted to read. (<http://www.rocketbook.com>)

There are some convincing reasons for designing an electronic book and also some reasons that electronic books should not be designed. One article in a technology online journal (<http://www.zdnet.com/devhead/alertbox/980726.html>) says that electronic books are an attempt to go backward. Instead of using the new technology in a manner that enhances and changes the way we look at things these devices try to fit the technology into our old frame of mind. Web technology allows us to read in new ways using hypertext, which can more easily follow our needs and interests. This paper is a linear version of this material, but you can also look at the same material on the World Wide Web and read it in a hypertext manner. Online you can choose what you want to read

and what order you want to read it in. If there are particularly interesting points you can choose to link out to other sites that go into more depth. As a reader it is good to compare the two approaches to see what makes sense to you.

Electronic books might also be a good way to replace textbooks in schools. A publishing company could make the content available through their web site and for a minimal amount sell the “readers.” Updating of texts would be simplified. Drawbacks of this are that the devices themselves would be a large initial expense. Dealing with the wear and tear that a student population would give to e-books is another problem. The whole idea is too new for any business to take such risks.

One other effort that is being made that involves technology and books is putting books online. These books are not accessible by a “reader,” but can be read on your computer. A whole computer is difficult to take with you wherever you go, but these web sites allow access to some texts that you might never find. The first of these efforts to digitize books is called Project Gutenberg (<http://promo.net/pg>). It is worth reading how Michael S. Hart came up with the idea for this project. Keep in mind that there were very few computers in 1971 when this happened. In order to use a computer there was an hourly charge. Michael S. Hart received an unexpected \$1,000,000 worth of computing time:

“At any rate, Michael decided there was nothing he could do, in the way of ‘normal computing,’ that would repay the huge value of the computer time he had been given . . . so he had to create \$1,000,000 worth of value in some other manner. An hour and 47 minutes later, he announced that the greatest value created by computers would not be computing, but would be the storage, retrieval, and searching of what was stored in our libraries.

He then proceeded to type in the “Declaration of Independence” and tried to send it to everyone on the networks. . .”

Michael Hart’s dream was to make literature available to everyone for free. His vision is that no one should have to count the cost of reading a book and that quotations should be freely found and shared. His digitized books are in “plain vanilla ASCII” (a very basic computer code that can be

read by any computer or word processor) so that there are as few limitations as possible to their access. Project Gutenberg is very active and have now released more than 2000 texts. The project has a goal of releasing 10,000 books by 2001.

Books On-Line (<http://www.cs.cmu.edu>) is an effort to give free access to books by putting them online and by linking to many other efforts that are putting text online. In an e-mail conversation the creator of this site, John Mark Ockerbloom explained that most of the readers of the online books are people who have visual or physical handicaps which make it impossible for them to use books. An online book can be read aloud by a text reader for a visually impaired person. Someone who is unable to turn pages may be able to push a button or some other movement to turn pages digitally. He added that an online book allows people to read important sections, search for specific text or even to hyperlink to their own site. Occasional users even print out whole books and read them this way. Mr. Ockerbloom's motivation for this project is go give people free online access to literature. In the early 90s when he heard Michael Hart's goal of putting 10,000 books online by 2001 he thought it was impossible. He recently (10/7/99) sent out a message stating that the 10,000<sup>th</sup> book had been digitized. He is counting books from many different digitizing efforts, not only his own organization. Many smaller rural public libraries have fewer than 10,000 books in their collections, so with a hook up to the Internet they are substantially increasing their collections.

Scholarly efforts at putting certain types of literature online are also common. The Perseus Project (<http://www.perseus.tufts.edu/>) is working toward the goal of placing all of Greek literature on the web. It is a non-profit enterprise, located in the Department of the Classics, Tufts University with lots of outside funding. The Perseus site is world acclaimed and is appreciated by educators and students everywhere who are interested in ancient Greece. There are many other projects similar to this, which are putting important literary works online for academic reasons. The Electronic Library is another resource that provides whole text of many journals. It is becoming a very useful resource for teachers and students in Missouri and other places.

A research project called XLIBRIS is being worked on in the FX Palo Alto Library. (<http://www.fxpal.xerox.com/PapersAndAbstracts/papers/mar99a.PDF>)

The XLIBRIS is an active reading machine. Based on the idea that reading+critical thinking+learning=active reading, the reader augments your reading. As you read a text you can make notes in the margins. The XLIBRIS automatically takes the text of your notes and using Keyword searching creates links to similar passages in the book and to outside web pages that are related. It is also capable of running in a skimming mode where it automatically highlights the main ideas. Because this is an academic research project rather than a commercial product, it is not available for sale. Research with XLIBRIS is in progress now.

## EMERGENT READERS

So far the technologies that we have talked about have been created mostly for competent readers. Now we will explore what the Internet has to offer for literacy instruction. Current research shows literacy educators that there is no one best way to teach reading (Cunningham, 1992). In order to reach students many different approaches must be used requiring good observation and decision making by a teacher. Great progress has been made in recent years in brain research. It has supported the conclusion that there is no one best way to teach reading. The process of learning to read is extremely complicated. It involves many parts of the brain working together to arrive at final meaning (Meyer, 1998). Even the simplest tasks in reading involve processing and cooperation from many parts of the brain.

Recognizing phonemes, graphemes and their relationship are major parts of word recognition. Computers offer a stimulating way for emergent readers to work on these concepts. There are many CD-ROMs and computer games designed just for this task. They are usually games that provide motivation and repetition. The auditory capabilities of computers allow sounds and words to be “read” to the user as well as pictures and text. These programs can allow a child to hear as well as see a letter and words that use that sound.

Often the goals that software is created for does not match the benefits that students receive from it. One example is the Magic School Bus Series of CD-ROMs. They are companions to the very popular book series by the same name put out by Scholastic. Each CD-ROM title supports literacy integrated with curricular material. The CDs include animations of the Magic School Bus, the teacher, the students and the situations that they experience. A user is in control of clicking on things to find out what will happen. Many students will click over and over again on something that they found particularly entertaining and often these parts of the program have very little to do with literacy. A common event I observed involved one of the characters in the Magic School Bus in the Human Body who had a hand held computer game. When a student clicked on his pocket the game opened up for the user. This particular game brought up a drawing screen where students could squirt bodily fluids to make a picture (pick up the nose and squirt mucus, etc...) From an adult's perspective it was gross, but kids loved it. But what learning was being reinforced? Teachers who are excited about technology sometimes forget to ask, "What are they learning from this?" and, "How can I design my lesson in a way that incorporates this software in a meaningful way?" With some guidance and planning the Magic School Bus CD series could be an excellent addition to a literacy classroom, but it can also be a waste of time. It depends on how it is used.

This was also discovered in a study comparing children's story comprehension. The study was set up with three groups. The first group of children listened to a story read aloud by an adult, another group used a computer to look at a Discus Book (CD-ROM which reads aloud and shows the names of the things in a picture when clicked on), and the final group used a computer to read a Living Book (also a CD-ROM which reads aloud, but has entertaining animations to go with each page of text). It was found that the comprehension was best when an adult read to the child. However, the children gave much more attention and spent more time on the Living Book. The authors of this study suggest that there are some aspects of the technology that are worth using, but that a teacher must be careful to choose software carefully. Also, software designers must be aware of the ways that some of the animations can mislead children rather than helping them to understand the story (Okolo, 1996).

Using the Internet with emergent readers is not simple. The emergent reader is dependent upon graphics, which tend to download slowly depending on the connection. These students also have shorter attention spans, which makes using web sites less effective. It is a challenge to develop highly graphic and interactive sites that download quickly and are easy to use. Increasingly teachers are putting out content for this age and it will not be long before the problems with bandwidth, which make graphics download slowly will be improved. At this point we are only at the very beginning of seeing really useful applications for emergent readers on the Internet. It is just a matter of time before this happens, though, and it is important that professional educators have input into the content of web sites aimed at beginning readers.

#### E-MAIL

One of the earliest and most successful ways that technology has contributed to literacy learning for students is through e-mail. An example of this was written up in *The Reading Teacher's* April issue (McKeon, 1999). In this particular project 4<sup>th</sup> graders (9 and 10 year olds) corresponded with pre-service teachers as part of their elementary language arts program. The author emphasized the need to think about the goals of their technology use first. The computer should have a pedagogical advantage if it is to be used. This study which analyzed the communication between the students and the pre-service teachers concludes that using e-mail introduces students to a "powerful, personal, technological, thinking tool." E-mail can give students a new motivation for reading and writing. Many teachers are using e-mail to help their students connect to people all over the world based on areas of their curriculum. There are e-mail lists available to help teachers find keypals and projects and even experts with whom they can communicate (see Webliography).

One project for second grade is very popular. It is called the 100s day project. Many classes at this level count the first days of school and celebrate the 100<sup>th</sup> day. This project involves sending and receiving 100 e-mail messages. The class that participates can prepare a 100s day greeting and then send it to 100 other classes of their choice from the list. After signing up the class begins to receive

e-mail greetings from all over the world. In one school these messages were then posted on the wall with a world map to show where they came from. Each day a student got a chance to read one of the messages to the class. Since they came from other second grade classes the messages were usually readable by a second grader. The teacher encouraged parents in the class to write in also. Students got a chance to receive e-mail from their own parents. At the second grade this is a powerful motivation to read and write.

## THE WORLD WIDE WEB

As readers progress in the basic word recognition skills more of their attention can be put on attending to the meaning of text. Anne Meyer in *Learning to Read in the Computer Age* makes the point that successful readers construct understanding from text. In order to do this they must be engaged in what they are doing. Students need to be reading from an intrinsic motivation as well as an extrinsic one. The more interesting a text is to a student the more likely that he/she will put the effort into the deeper skills of comprehension. One of the Principles of Engagement offered by Brian Cambourne (Cambourne, 1995) is that, "Learners are more likely to engage deeply with demonstrations if they believe that learning whatever is being demonstrated has some potential value, purpose and use for them." He also states that in his explorations, "If students didn't engage with language, no learning would occur".

The Internet can provide scaffolding for students learning by engaging them in an authentic and meaningful task. "The World Wide Web is an authentic communication environment offering almost infinite opportunities for highly engaging literacy development" (Meyer, 1998) As a technology teacher I have watched kids who can barely read enthusiastically attempt to read a web page to find out something meaningful to them. One of my most rewarding experiences using the Internet at school occurred with a fourth grade student. His class had come to the lab to find out some information about Alaska. Don (not his real name) was on the Internet and came across a school web page that had picture of the exact area that he had been learning about in class. He became so excited. The students who created the page described how they had chased a moose off of the playground

that morning and that for PE they were doing cross-country skiing. When he read that to the class the look on his face was unforgettable. He then noticed that the teacher page had her e-mail address on the page. Somehow that piece of interactivity motivated him to want to write like nothing else in his experience. We set him up and he wrote the teacher who created the page a letter with several questions. Since then I have been convinced that the Internet should be used more intentionally for literacy (reading and writing) instruction.

Another method of incorporating web sites into instruction is called the WebQuest. The model of a WebQuest created by Bernie Dodge and Tom Marks has several parts. It begins with a page that is the starting point for the students. This page tells the student what their task will be, lists web resources (links) that they can go to, and usually connects to a scoring guide that gives the student an idea of what the final outcome will be. After reading through this page students should have all of the tools and information they need to begin the task. A WebQuest allows students to use the Internet without having to waste time searching. Because of its careful design it guides students to good educational web sites so it is less likely that they will spend time on inappropriate sites. Teachers all over the country are designing WebQuests that connect to their curriculum. All of the WebQuests involve reading although they are usually created around another curriculum area. There are many lists of WebQuests available. (see Weblibliography)

In the last year I have seen real excitement from teachers about using WebQuests. I recently decided to create one designed to enhance reading instruction. I hope this WebQuest will reach those students who have decided that they do not like books. It is called Surf'n and you can find it at <http://www.more.net/~janice/webquests/surf'n> . I used several of the suggestions that I found in *Learning to Read in the Computer Age* and other readings cited here as I designed the activity. It is based on the idea that the best way to learn to read is to read. Reading itself is the step to becoming a better reader. So this quest was designed to engage students to read and write about a subject they choose from a list. Writing and reading are both included because they are complementary skills. I also wanted the task to have varying levels of challenge. The task described in the quest can be successful when done at various levels. It is created with older students in mind (5<sup>th</sup> grade and above), but

the web resources are at various levels so that different levels of learning are scaffolded. Feedback is also built into the quest. The students who participate will create a simple web page about what they learned for a younger student. The younger students will send a message to the creator of the page with a question and hopefully some dialog will begin. Finally student choice is built in as central to this quest. Students will be able to choose a subject to read about that is meaningful to them. Their prior knowledge of the subject should provide them with the connections they need to make the task meaningful.

The task in Surf'n is to choose a topic and then to read about it and create a web page on a simple template about the topic that can be read by younger students. Students can take graphics and information from the web pages that they search to create their own page. The web page that the students create will have a guestbook on it and the younger students will be asked to sign the guestbook and to ask a question. The older student will receive some feedback on their work and possibly begin a dialog with the younger student.

#### AUTHOR WEB PAGES

There are many ways to use the Internet to engage students in literacy activity. Meaningful, authentic connections can be made to authors through the Internet. Another story from my experience can illustrate this. At my school in 1997 we were planning to have an author visit. I mentioned an author I knew and the Media Specialist suggested that I e-mail her. She happened to be online when I wrote and answered right away. We came close to arranging the whole author visit in a few minutes of writing back and forth. Deborah Hopkinson came to our school several months later and some of the kids presented her with drawings that they did about her book. She scanned one and put it on her web page. You can see it at her web site:

<http://people.whitman.edu/~hopkinda/>

If you click to learn more about the drawing you will also see a list of all of the pets at the author's house and you are invited to write her son about all of the pets at your house.

Many authors have personal web pages and there are web pages made by other people about some authors. At these sites a student can usually learn the history about the author and see a picture of them. They can learn that these are real people and identify better with them. Some of the authors put games and puzzles on their sites especially for the kids. An exemplary author sites is the Jan Brett site <http://www.janbrett.com/>. It is regularly updated and includes many beautiful, useful and interesting things for teachers and students. The Webliography contains a list of many author sites and sites that link to authors.

## DISCUSSION LISTS

One other aspect of the Internet is its support of professional development for literacy teachers. One way that this is done is through facilitation of communication between teachers. A discussion list connects a teacher with a group of other teachers all over the nation or the world that are interested in the same topics. There are hundreds of lists that one can join on various topics. A list of some of the most common ones about literacy is listed in the Webliography. Through the book, *Effective Literacy Instruction* I joined a discussion list. It is meant to support preservice teachers who are reading this book and thinking about literacy instruction. I wrote a note into the list expressing appreciation for the design of the book, especially in practical guidance for integration of technology. Donald J. Leu, the author wrote me back in person and pointed me to his personal web page for more information. It linked me to several of his newest articles that are scheduled to be published in the coming year.

The ability to learn from teachers all over the world easily is a contribution of the Internet that is totally unique. Imagine if I had sent a (snail mail) letter to Donald J. Leu and told him I liked his book. He might have written back, but even if I had gotten it before the end of the semester I would not have had a chance to look at his web page and recent writing. Discussion lists about various parts of literacy connect teachers who have various experiences and give them a chance to learn from each other. For example in one of the lists from The Children's Literature Web Guide, a teacher wrote seeking a book that she remembered a part of the story of and did not remember the

title or the author. Within the same day someone responded with a title and author for the book. It is really amazing. After reading a list for a while it is possible through the postings to make new contacts and recognize individual participants. It is a new way of developing a professional connections for support and learning.

## TEACHER SUPPORT

The World Wide Web is full of sites intended for teacher support. The difficulty is deciding which one to use and finding the time to use it. There are lists of web resources, lesson plans, grant information and guidance. There are also booklists of award winning books and recommended reading. One helpful and important site is The Children's Literature Web Guide. It links to several important lists of Authors, award winning literature, and even a few discussion lists on reading. A few other selected teacher support web sites are listed in the webliography.

The Internet is a new medium and teachers are busy. Finding time to learn how to incorporate the Internet into literacy curriculum is not easy. Donald J. Leu in his textbook *Effective Literacy Instruction* (Leu, 1999) suggests four Frameworks for Literacy on the Internet. They are:

- ◆ Internet Activity: A WebQuest can be an Internet activity or they can be less structured where a teacher selects a web site related to instruction, develops an activity related to this site, assigns the activity, and ends with kids sharing their work. There are many places on the web where teachers can go to look for lesson plans so it may be possible to find one that fits your needs.
- ◆ Internet Project: Leu suggests that the teacher develop a collaborative project, but there are many projects available for participants so it is not essential to design your own. Good projects are posted on the Internet with a clear timeline and instructions for participation. (See the Webliography for some project sites)
- ◆ Internet Inquiry: This is using the Internet as a research tool. The steps suggested are question, search, analyze, compose, and share.
- ◆ Internet Workshop: This is time set aside each week for sharing what students have learned on the Internet. It is a time when questions can be asked and answered on technical or curricular subjects.

## REDEFINING LITERACY

Our current students will become adults in a world that demands a different type of literacy. It is becoming more and more important that students are graphically literate. Producers of television, graphic advertising and web pages communicate using sophisticated visual data. To be successful as adults the students of today will need to be able to express themselves in this way as well as evaluate what they are seeing and reading.

The explosion of information and the fact that the Internet is an open publishing environment means that we have a responsibility to teach our students (and first of all ourselves) how to judge the value of information found on the Internet. Truly literate students will recognize the value of both books and the Internet and will have a sense of what can be found best in either place. The Internet is an amazing resource of information, but not always the best resource. It takes time and experimentation to learn the difference. Teachers who only use books, or only use the Internet are limiting the opportunities that their students have to learn.

The meaning of literacy is constantly changing dependent upon the technological context in which it occurs. Success in our time means that we have information access, problem-solving ability, and know how to communicate. Being literate requires learning sophisticated searching strategies. It is not something we learn by the end of elementary school and then are considered literate, but is a developmental process that will continue all our lives. Most importantly for our species is the fact that literacy now requires new forms of critical thinking and reasoning (Leu, 1997). Information is expanding at a faster rate than any time in history. Instead of knowing certain facts, students today need to know how to find the facts that they need to solve specific problems. The emphasis has changed from teaching specific facts to teaching how to learn. Being able to evaluate the validity of information based on its source and other clues, being aware of the purpose behind the use of graphics, knowing where to go to look for answers to various problems are the types of thinking that need to be emphasized.

## SO WHY BOTHER?

There are many obstacles to successful integration of technology into schools. Most schools lack a sufficient amount of equipment for successful integration. In the schools that have equipment there is often little technical support to repair things that go wrong. Often good equipment sits unused for months because it is on an overworked technical support person's long "to do" list. Staff development is a big hurdle. In a recent survey the majority of teachers stated that they felt unprepared to use the Internet with their class. Even those teachers who have taken some staff development are reluctant to try things because there is no one to go to for help. "Given the many obstacles I have come to realize how remarkable it is that even a small percentage of educators would bother trying to integrate technology into their instruction." (Reinking, D. 1997)

It is a fair question to ask why we should bother to spend the great effort and money it will take to integrate technology. In an article that is scheduled to appear in *Reading Research Quarterly* in January of 2000, Donald J. Leu talks about the convergence of literacy instruction with Internet Technologies. He points out three forces that are converging and causing fundamental changes in the nature of literacy and literacy instruction. Global economic competition, public policy initiatives and literacy as technological deixis (technological deixis is a term he uses to talk about the constant changes in the definition of literacy instruction depending upon developments in the area of technology) are these three forces. In this article he describes how global economic competition is changing the nature of work in our society. The economy is no longer based on capital, but on knowledge or information. A person gets ahead because of what they know, how fast they learn, how they solve problems, and how they work with others. Public policy regarding literacy and technology is being worked on in many nations. Among the nations mentioned in this article are the UK, Finland, Ireland, and the United States. Literacy changes because of rapid technological change. The forms and functions of literacy change as new technologies for information and communication emerge.

A strong case is made in his article for the urgency of changing our instructional strategies for the benefit of our students. In spite of the great challenges to literacy instruction using technology, it is

essential that we keep up. There is a reflexive relationship between literacy technology and us (Bruce, 1997). Just as technology changes and we must adapt to it; as we adapt we also change and create new technologies. The two sides cannot be separated. One interesting argument used in Bruce's article is that; "critics of the Internet culture can now be found most easily on the Internet itself. They are indexed by search engines, linked to web pages, and read through Internet connections. They thus add to the richness of the Internet." The new technology has become the best way to communicate and therefore even its critics have begun to use it.

Leu even goes so far as to argue that we cannot afford to wait for solid research data before we go on with technology. He says that it is a moot issue. Even a recent report, the President's Committee of Advisors on Science and Technology states that, "The panel does not, however, recommend that the deployment of technology within America's schools be deferred pending the completion of (a major program of experimental research)." Technology has been changing so fast that it is like a moving target. By the time a research project is done the technology it was exploring has been replaced by something faster and better and the results of the research are already out of date. A good summary of his argument is:

Who needs hard data on the beneficial outcomes of new technologies for literacy or learning when it becomes clear that these technologies or their related successors, will be the technologies of our children's futures? While some could argue we must wait until compelling data are available; I would argue that to wait for these data will make them useless since new technologies will have appeared by then. If it is already clear that the workplaces and higher education have become dependent on networked information environments such as the Internet, who has the luxury of time to wait for a consistent body of research to appear, demonstrating their effectiveness? Research might be better spent exploring issues of how to support teachers' efforts to unlock the potentials of new technologies, not demonstrating the learning gains from technologies we already know will be important to our children's success at life's opportunities. (Leu, in press)

A teachers mailing list called RTEACHER has begun to present an award to teachers who are working on issues of unlocking the potentials of new technologies and sharing what they find. This may be the best way for us to measure what works in literacy learning with technology. The award is called the Miss Rumphius Award and was named after a children's story character that tried to make the world a more beautiful place wherever she went. She planted lupines and that is the symbol for the award. You can find a list of the award winners at:

umphius.html <http://web.syr.edu/~djleu/RTEACHER/rumphius.html>

Technology has radically changed the way that tasks are done in my daily life. I wake up to a digital alarm clock radio that is tuned to a station that plays news feeds from distant places.

Much of the news shows how much technology is changing how we view the world. News of the Stock Market, earthquakes, and even election news is impacted by technology available today. I get into my car and drive to a gas station that has new pumps that are somehow connected to the cash register in the store. At work I must use a computer and communicate with e-mail. I can even order my lunch by fax or online. It goes on and on. I struggle with the idea of cost and wonder how schools can keep up with the costs. A recent article on the Digital Divide saying that family income has a great impact on who has computers and is online is also disturbing. But at the same time it is clearer than ever to me that technology will only become more important.

Technology isn't everything. Healthy child development means spending time playing, experiencing nature, reading books, singing, creating, and so many other things. In my opinion schools need to work on integrating technology so that it is 'transparent', meaning that it is something that students learn to manipulate and use, but don't really notice. Development and learning depend upon rich experiences. Technology is only a way to process what we have learned and communicate it to others.

Nicholas Negroponte wrote a thought-provoking book in 1995. He explains in a very interesting way the mind change that technology will require of us. Like the first creators of TV we are stuck with an old mindset that makes it hard to envision the future. In *Being Digital*, Negroponte argues

that we are coming out of a world that was based on atoms and moving into a world that is based on bits. The important things that we have had in the past were all made of atoms. Books, possessions, money and so many more things are made up of atoms. They are physical. The future, claims Negroponte, will be concerned instead with information technology. More and more the things that are important will be made up of bits (a computer term for the smallest piece of information). We will convert things to bits and then transport them easily from one place to another. The electronic book is an early example of this. What used to be atoms (cardboard, paper, ink...) has been made into bits (digital) and can be sent quickly over wires and retrieved at another place. Online banking is creating a situation where it is almost possible to live without physical money. Almost all transactions now can be done online with no paper or coins changing hands.

It is not clear if Negroponte's view of the world is going to come to pass, but it is clear that many of his predictions have come to pass. An effort has been made in this paper to illustrate the fact that literacy is changing. It may not really be too late yet to read this paper in its physical form, but the form you can find online (<http://www.more.net/~janice/literacy/>) is much better suited to going deeper and finding more information. In order to read the online version successfully the reader will need to focus in a different way and avoid meaningless surfing. The reader will also need to be aware of the various sources of information on the links and judge if they are valid. Literacy has changed and will continue to change.

