

AC 2007-1316: WHOSE JOB IS IT? TECHNOLOGICAL LITERACY IN SOCIETY

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Abstract

This research explores the effects of technology on society, especially the technologically illiterate, who struggle under the surge of modern consumer technologies that penetrate the market. Whose responsibility is it to educate the average American? Who should train them to control the technologies they deal with every day? Who should show them how to access technology in order to enable them to protect and educate themselves?

Is it the role of engineers, the creators and developers of new technology, to teach society to understand that technology? Should educators conduct outreach programs to train the communities in which they reside? Is it the government's responsibility to provide the information needed for citizens to effectively manage and utilize the ongoing influx of new and improved technology? Should the responsibility be left to parents to be self-educated and to teach their children?

In this age of diverse methods of communication and dissemination of information, we have access to so much more than our forbearers imagined possible. It is important for people to understand technology and to be competent users. With so much innovation some get lost in the flow of new technology and can not seem to manage the information entering their environment. Some lose control of their privacy and become victims of theft because of ignorance. Many adopt a fatalistic mentality and simply accept their ignorance because they feel overwhelmed or afraid of the dangers of technology. Conversely, education spawns feelings of safety and security because knowledge empowers the individual. Whose role is it to promote educated, communicative, and innovative users? This research explores the complex issues dealing with society's interaction with technology and provides clarity regarding these issues.

Introduction

“Knowledge will forever govern ignorance; and a people who mean to be their own governors must arm themselves with the power which knowledge gives.” --James Madison¹

The effect of technology on society as a whole and on individuals is of great concern. For over a year several faculty and student researchers at Brigham Young University have been researching the effects of technology on society and the family. Despite its importance, this topic has been largely ignored². However, a discussion with an average American illustrates that many experience frustration with their everyday technology. They feel “technologically illiterate.” The potential problems associated with technological illiteracy reach farther than feelings of frustration. Technology has direct social, economic, and moral implications for our society^{3,4,5}.

Technology in everyday life has become a hands-on learning experience dependent on user-friendly technology. The permeation of technology into our lives is presenting more and more challenges along with benefits⁴. With technology pouring in at an unprecedented rate, we are ill-prepared to handle it⁴. Parents fear for their children and don't know how to protect them. Learning about even one technology can lead to myriad questions that go unanswered. A

fatalistic mentality is sometimes adopted concluding that either you try to muddle your way through or dispose of the technology altogether. Each of these approaches has their own problems. Eliminating the technology puts you out of touch with much of modern society, and struggling with technology is frustrating and inefficient. William A. Wulf, president of the National Academy of Engineering explains, “Less tangible perhaps, but nevertheless very disturbing, are the potential long-term, cumulative consequences of living in a society increasingly dependent upon and at the same time relatively ignorant of the technological workings of the world².” He further goes on to say, “The impact of technological illiteracy might be played out through... more frequent and damaging misuses of technology; and more frequent and serious missed opportunities for exploiting technology for the benefit of all citizens².”

Whose job is it to help the average American get control of their technology? With the right tools, families can learn how to manage their environment. They can learn to manipulate technology effectively, enabling them to develop a better quality of life and protect themselves from its pitfalls. As James Madison¹ commented, knowledge empowers the individual. It spawns feelings of safety, security, and opportunity because knowledge gives power.

Should engineers and the developers of technology have a responsibility to the public to educate those who purchase and use their products? Very often instruction booklets for technical appliances explain how to complete specific tasks, but seldom do they explain the impact those tasks will have on the user experience. For consumer products, for example, they could include a pamphlet or information booklet along with the instructions containing tips on why and how to effectively use parental controls, filters, ratings, internet history, etc.

Should educators have a responsibility to their communities to provide technological literacy programs and courses? Because educators become experts in their subject area and have access to resources that others may not, should they be responsible for contributing more than they are? Educators’ responsibilities do not need to be limited to the classroom; they can extend to the community as a whole. Educators’ expertise, offered to parents as well as students, can be a great addition to technological literacy programs in various communities. Some people simply don’t know where to begin. Even something as basic as an overview of different technologies can provide a starting point for families.

Is it the responsibility of the government to legislate the use of technology? They have the power to create laws. For example, they could create a law that every pornographic website must first direct the user to a warning screen that informs them of what they are about to access. This would protect Internet users from any pornographic pop-ups or accidental searches. With legislation comes the ability and responsibility to enforce correct action. Should the government be more involved in educating and protecting society?

Must the weight of managing new technologies rest on parents and families? Should they be solely responsible for educating themselves? Parents have the responsibility to protect and teach their families, but who will help them? Families need help to get a grasp on managing and controlling technology so that the effect of it will enhance their quality of life rather than detract from it.

What is Happening to Families

A Socializing Agent

When people don't know how to use technology effectively they are left unprotected and vulnerable to the varying influences that use technology to disseminate information, products, entertainment, etc. Frustration with technological devices leads to loss of control over what people choose to bring into their environment. Technology provides a venue for the socializing influences that they may or may not desire.

Technology has been referred to as a socializing agent⁶. In our society the media is pushing the boundaries of moral standards (examples of which will be cited later). The role of technology in regards to the media is that it disseminates information more quickly and easily. Technology providers know that entertainment in all its forms will sell their product. Video games, computer games, internet content, movies, DVD's, music, etc. get the attention of consumers. The trouble is many aren't learning how to effectively control the devices that provide venues for these socializing influences. Once people learn to control their TiVo's or video cell phones they will then have the ability to accept and reject the media content *they* choose. Thus, technology will enable them to eliminate negative influences and shape their own environment.

With the world's pace speeding up to match the abilities of technology, some may feel they are falling behind. They are able to grasp enough of how to operate technology to get by, but they do not really understand it⁷. According to Ollis and Krupczak, a non-technical audience must understand the design process of engineers to become technologically literate³. This literacy empowers the individual with the knowledge and capabilities⁴ to make better decisions and choices. Technological innovation seems to continue at an ever increasing rate. Without an understanding of new technology, how can the average American make sure it is working for them and not against them?

“Television has become so entrenched in family life that it needs to be considered a socializing agent comparable to parents and educators”⁶. Several studies have shown that children do interpret reality modeled on television. Children perceive family sitcoms as reality, and therefore react to real life situations in a similar manner to that of the family sitcom characters. “Television presents an extensive array of emotions and emotional situations, it seems reasonable to expect that this medium serves as an important source of information about emotion, especially for children who are in the process of learning about affective experiences”⁸. Other research has also shown that children can indeed learn from observing models on television⁹ and that this learning can endure for many years beyond the viewing experience¹⁰. It is not uncommon for children to react the way their peers do in these family sitcoms.

All media (video games, music, movies, Internet content, etc.) are in fact socializing agents, and as it gets easier to disseminate media via new technologies the effect of these socializing agents will increase. Recent new technology can provide even more avenues for the media to influence as never before.

Loosening Standards

One example to illustrate how standards in our society are loosening is that of Alfred Hitchcock's famous movie *Psycho*. This film was made in 1960 and given an "R" re-rating in 1984¹¹. If you compare *Psycho* with television programs today, it is difficult to believe that it ever received an "R" rating. This example, along with many others, proves the evolution of society's standards of what is acceptable and what is not. The more crude, vulgar, and explicit the media becomes the more in danger our society becomes¹².

This burst of access to all the world's knowledge is nothing less than a miracle. Along with the miracle, however, there come certain risks. Pornography is one of the most threatening sides of the internet. According to Finkelhor, Mitchell and Wolak, 25% of youth who used the internet regularly in 2002 were exposed to some form of unwanted pornography while online¹³. Currently there are no standards or guidelines for what content is placed on the Internet and no age restrictions of those that view that content. Wireless networks and hand-held Internet accessible devices will only aid in the dissemination of inappropriate content to children if there is no regulation and control. According to ConsumerSearch.com, "Some of the most insidious online threats are rooted in instant messaging"¹⁴. With so many youth using instant messaging this is of great concern. Similarly, peer-to-peer (P2P) file sharing can expose people to objectionable material. On various P2P sites children are dealing not only with the dangers of pornography, but also with liability issues such as sharing copyrighted material¹⁵. The greatest number of P2P searches was for video files, 63% of those searches were for pornography and twenty seven percent were for copyrighted material¹⁶. A panel of experts at the Utah Council on Family Relations held in April 2006 said that file sharing websites such as Myspace.com are growing by thousands of memberships every day. They explained that in 45 seconds a predator can obtain a child's name, address, age, sex and even information such as when their parents are at home¹⁷.

These areas are only a few that technology needs to address. Are we trying to develop technology that protects us? Some biometric technologies have the potential to do so. Fingerprinting, for example, is already used in places such as banks and gas stations. This technology could be developed to oppose the abuse of technology by those who wish to harm the most vulnerable segment of our society, our children. What other innovations can help protect us?

Increased Isolation

While many claim that technology has improved our quality of life, others claim that the opportunity cost of technology is a lost sense of connection with our fellowman. There is debate over whether Internet, computers, and digital devices have an asocial effect, creating increased isolation and loneliness or whether they improve social ties. According to Kiesler et al. technology does create feelings of isolation¹⁸. Kiesler et al. performed a study using ninety-three families in their first one or two years of computer and Internet use at home. Based on the results of their study, they believe that increased use of the Internet decreases social involvement including family communication thus increasing loneliness and depression¹⁸.

Interpersonal communication is evolving because of the Internet. What was once face-to-face interaction is now “virtual” communication. This can have both positive and negative effects. Online social networks, for example, help to keep families and extended families connected even across distances. “Franzen found that over time use of email had a positive effect on the maintenance of social ties”¹⁹.

Increasing technology in the home is not always beneficial. Multiple televisions, for example, do not necessarily decrease family conflict. This can be explained by the increased level of isolation surveyed family members encountered²⁰. Interestingly as well, in families where parents spent less time monitoring the television programs their children were watching family members felt more isolated⁶. Multiple devices often draw individual family members to separate and isolated areas in the home. Thus, communication diminishes and families are losing their connection to one another.

If used properly, technology can enhance our interactions and increase communication. It will help to improve our interconnectedness and diminish our solitary condition.

Education vs. Entertainment

With technology today we have the power to reach farther than ever before, to become more than we thought possible, and to help each other in our individual paths of becoming. Technology presents a greater opportunity for learning than ever before; yet entertainment seems to be its most popular use. This focus on entertainment may become a distraction from the possibilities that are becoming more available to us. As already discussed, entertainment is continually loosening its standards and thus, as a socializing agent, can have a detrimental impact on all of us. Education though, provides the necessary knowledge and skills to enable individuals and families to accomplish and contribute more.

An understanding of technology and the skills to use it effectively will enable people to build the kind of life they are working toward. They will be better prepared to choose what kinds of influences they allow into their lives. They will then be able to shape the effect technology will have on society in the future.

What is Being Done

Many companies and organizations are working to alleviate the growing problem of technological illiteracy. There are resources for those seeking education. The National Academy of Engineering and National Research Council have established a committee on technological literacy. This committee produced a report entitled *Technically Speaking: Why All Americans Need to Know More about Technology*⁴. Through their research they developed three dimensions of technological literacy: Knowledge, Capabilities, and Ways of Thinking and Acting. Competency in these dimensions moves from limited to extensive, low to high, and poorly developed to highly developed respectively (see figure 1).

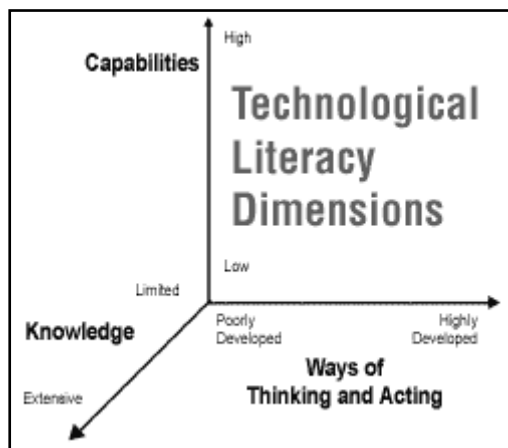


Figure 1

This model presents an interesting view of technological literacy. The three dimensions, knowledge, capabilities, and ways of thinking and acting (later renamed “critical thinking and decision making”), are depicted as beginning from one point and moving outward in different linear directions. Together the three dimensions create a multidimensional model. Knowledge and capabilities can perhaps be measured linearly by testing an individual, but critical thinking and decision making vary according to the level of the other two dimensions. This can only be effective with some knowledge of technology and capability or skill with its use. This last dimension is the most critical. Knowledge and skills are nothing without the proper exercise of agency.

The International Technology Education Association (ITEA) has produced several publications concerning technological literacy. These publications offer standards of what students should know and be capable of in regards to technology. They discuss technology curriculum in schools and whether a structure for learning can survive with the rapid changes in technology. *Technological Literacy for All* defines what technological literacy is and why it is important. They conducted Gallup Polls to find out what Americans think about the subject and concluded that the majority of Americans believe it is valuable and should be implemented in educational systems²¹.

The U.S. Department of Education is working toward increasing technology education in our schools. They argue, “It is the responsibility of this nation’s educational enterprise – including policy makers – to help secure our economic future by ensuring that our young people are adequately prepared to meet these challenges”²². They have provided steps to improving technological literacy in schools. Similarly, among the objectives of the National Science Foundation are, to “promote access to information technology for all students” and “expand science, mathematics, engineering, and technology training opportunities at institutions of higher education”²³.

Many organizations have developed websites to provide resources for families to better protect themselves from the dangers of technology, particularly the Internet. Companies such as Microsoft are teaming up with non-profit organizations to provide technology education to

underprivileged individuals in local communities. Microsoft believes that as they provide training and tools they can create “social and economic opportunities that can transform communities and help people realize their potential”²⁴.

What Still Needs to be Done

Ignorance and irresponsibility are a major threat to the positive impact technology can have on society. In her book *Technology and Literacy in the Twenty-First Century* Cynthia Selfe notes that the key to successful technological literacy is simply paying attention²⁵. She concludes that the responsibility for achieving technological literacy is all of ours: business & industry, government, educators, and parents. The average American is suffering from technological illiteracy. They learn just enough to get by, but need to increase their understanding in order to more effectively manage and control their technology⁵. More and more products are being produced and some feel overwhelmed and even afraid. With knowledge comes power¹ and in order to develop a society of critical thinkers and decision makers we must be educated.

Much is being done to improve and increase technological literacy for students, primarily K-12, but also for those in higher education. This will benefit our children and ultimately our future. Many non-profit organizations are reaching out to the “underprivileged,” extending the technology training they need to become employable. Technology literacy courses for the non-engineering major are being developed. Ollis and Krupczak suggest courses that teach hands-on design and engineering basics, the reality of manufacturing and engineering processes, and encourage “thoughtful analysis of technology and its impacts on culture and the environment³.”

A combined effort of engineers, policy-makers, educators, and parents is required to create a society of knowledgeable, capable, critical thinking and decision making individuals. The next stage of research should be for these four groups to unite in developing a plan to help average American families, especially parents, become technologically literate. This plan should include policy changes to improve the safety of technology (including media content). It should also include education on the fundamentals of technology, how families can use it for their benefit, how they can protect themselves, and how it can enable efficiency in their daily lives. The ways in which this information will be disseminated should also be included in the plan. Whose job is it to teach technological literacy? It is all of ours in a united effort.

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