Brains, Brawn and Bratwurst

Judith F. Bennett
csc_jfb@shsu.edu

Peter A. Cooper
cooper@shsu.edu
Computer Science
Sam Houston State University
Huntsville, TX 77341 United States of America

Abstract

Ignorance of technology is safe in simple societies, where the technology is simple and doesn't require great intelligence to manage, where it is relatively static and so skills once learned, and understanding once gained can be applied for a lifetime, where technology is not foundational to living and where such ignorance does not exact a heavy toll. As members of a technology-driven society, we must function on a level that is more than just getting out of bed and going to a job, coming home, watching TV, playing with the dog or kids, eating supper and going to bed. We are constantly faced with how to deal with the technology in our lives, an existence that is totally dependent on what happens in the digital world. Furthermore, the technology we face today is not the technology we will face tomorrow. Change is the only constant, and the pace of change is increasing. Traditional approaches to computer literacy typically address either the 'brains' approach, teaching the underlying processes involved in modern technology systems, or the 'brawn' approach, where functional skills are emphasized without a clear understanding of why things work that way. What is needed is a more integrated approach that connects the underlying processes with the functional competencies in such a way as to be useful in solving real world problems. This is 'bratwurst'.

Keywords: computer literacy, computer curriculum, teaching methods

1. Introduction

> "Whatever gulf separates the rich from the poor, an even greater chasm separates the armed from the unarmed and the ignorant from the educated. Today, in the fast-changing, affluent nations, despite all inequities of income and wealth, the coming struggle for power will increasingly turn into a struggle over the distribution of and access to knowledge." (Toffler 1990) "

Too often in our classes we hear the familiar phrase, "I just can't do computers. I just don't understand them. I'm computer illiterate". Every time this phrase (or one similar) is uttered in class, the instructor's sensors should go on high and try to make the student feel "not so dumb".

There is a societal perception that young adults, the so-called 'Millennial Generation', are technologically well equipped. This is true for the perceptions by older generations and by MG's themselves. The research record however, suggests that these perceptions are wrong (Shannon). While MG's have basic word processing, email and web surfing skills (not to mention game playing), it is clear that a) they do not understand the underlying mechanisms and systems that they are working with, b) they do not have a grasp of a wide range of applications that can be usefully used in a problem solving context, c) they are generally unaware of

the social, cultural, legal and ethical contexts that surround the use of technology, and as a result, d) they do not have the necessary background and skills to apply critical thinking skills to the solution of real world problems.

It is true that any individual may be able to function without a solid understanding of the systems they use, the novel ways in which they might apply them to solve problems, and the consequences of the use of those systems. The costs for society however, of widespread ignorance are heavy, including the stifling of creativity and progress, the economic reliance on those that do understand and the reinforcement of a digital divide that has its roots in economic and educational disadvantage. Apply the same argument to an understanding of our political systems to obtain a vivid picture of what those costs might be. Is it sufficient to know how to vote?

It is generally assumed that anyone getting out of high school should at least be minimally functional on a computer (i.e. basic office software use) and that students entering college should have little or no need for a technology literacy course. More and more, this is proving to not be the case. A surface examination of the realities of the situation reveals that students are taking a single semester or one year skills-oriented business computer information systems course or a programming course in their sophomore or junior year using equipment that is four to seven years old and an operating system at least as old as that. The emphasis is on skills acquisition, not thinking. The teaching quality ranges from the excellent, especially if they have been trained, to the abysmal leaving at best a six to ten year gap in technology by the time they leave college. The challenge is exacerbated when we consider that some of our most vulnerable populations (in Texas that means Hispanic and female students, in other areas it might be different groups) are the least comfortable and the least capable in a technological environment because they have had the least experience. Evidence seems to suggest (Dutton 2007, Horrigan 2007) that the home environment has as significant part to play as school.

This brings us to the question: Are we using the correct methods to teach technology to our students? Given the diverse backgrounds of our students and the relatively mechanistic approach to teaching technology in high school, it may be productive to examine both what we teach and how we teach technology.

2. Brains

Early in the history of computers, while processors were harnessed to provide solutions to very specific problems and while they were the domain of the military and the scientific community, it might have appeared both natural and necessary for 'computer literacy' to be concerned with the art and science of programming. So, off we went and taught them COBOL, FORTRAN, and assembly language programming, BASIC and RPG. We did not take into account that in order to do well in programming you need to be able to do well in math, think very logically and above all be interested in learning to program. Those students with strong linguistic or logical-mathematical intelligences (Gardner) performed well. Many other students came away hating computers and being very frustrated. The actual skill levels, capabilities, interests and needs of the students were never a part of the equation of what and how they should be taught.

It is unfortunate that there is a connection in many people's minds between human intelligence and 'machine intelligence'. Unfortunate in the sense that the virtues of machine intelligence; computational accuracy and speed, replication of results, automation of and subservience to mundane tasks, and the capacity for problem solving through functional decomposition, are often used to measure human intelligence value. While we place value also on the human ability to reason, it is deductive (procedural) rather than inductive reasoning that is prized and is most easily transferred to machines. We appear to be interested as much in using the machine as a model for human behavior as the reverse. In particular with the teaching/learning environment we often face students whose primary interest is in acquisition of the procedure rather than understanding of the concept. As Kant would argue, "Immaturity is the incapacity to use one's intelligence without the guidance of another." How often do we see common sense and reasoning checked in at the door?

It seems like we could take a lesson from

the construction of the microprocessors. They are growing smaller and smaller and the integrated circuitry is being packed in a more dense environment that ever before. We need to bridge the knowledge gap through packing smaller and denser bits of information into the students, however, it seems that anytime you mention the hated word "math" or "functions", they break out into hives. So many students have the attitude that "they just can't do math". This seems to be a real roadblock in their understanding of computer functions, applications, and general computer knowledge. If the students of today are going to be functionally literate in a wired society, we, as educators need to find a way to bridge the knowledge gap between those that are "computer savvy" and those that are "computer illiterate".

3. Brawn

With the introduction in the 1980's and 1990 of the ubiquitous computer in business, programming skills gave way to computer-based office skills, primarily word processing, spread sheets and databases, as the principle required skills in technology literacy courses. Skills acquisition by students was accomplished through rote mechanics, having little idea how all of the information, procedures and skills thrown at them relate to reality. This mode still has the ascendancy in universities today.

Students were not given an understanding of what it was they were trying to do. The "big picture" was missing in their education. One can liken the student of today to the 21st century model of a Victorian era factory girl – press this button, pull this lever. Too much of the precious classroom time is devoted to "press this button, pull this lever". We never tell them what happens when they press the button or pull the lever.

The approach to learning and the material in the typical technology literacy class are a matched pair. We appear to be much too concerned with "This is what [insert your favorite application here] can do", and forget the "for you" at the end of the sentence. Maybe we should just concentrate on the "for you". We teach procedure by demonstration and then require students to replicate, not stopping to consider why.

Intellect comes in different formats. Not everyone's brain is wired the same. There are those individuals that have the capacity to learn to program and those that will never learn to program no matter how hard one tries to teach them. There is nothing wrong with the vast majority of the students and their ability to learn about computers. The problem lies in the methods we use to stimulate learning and make critical thinkers of our students. We have failed to give them the tools they need to make critical decisions.

4. Bratwurst

It requires a skilled butcher to create a really good sausage. We are not talking about hot dogs here, where the least of the ingredients is meat, but a high quality bratwurst, using the choicest meat, best bread and carefully selected herbs and spices. The coarseness of the grind is important as is the care and attention paid to the grilling. You cannot make a bad bratwurst good by grilling well, but you can certainly ruin a good one.

A good Technology Literacy course should include the highest quality content that includes conceptual understanding, skills acquisition and application to the real world structured and presented in ways that whet the appetite rather than satiate. The vast majority of students will never write a program and furthermore have no desire to do so. The minutiae of the Word menu system can kill enthusiasm in seconds.

You cannot really separate the meat, bread from the spices from a sausage any more than you can separate the understanding of intelligent computer systems from the skills necessary to develop and maintain them. Our jobs as educators should be to focus on breaking down the tasks so that the students can work toward more critical thinking and purpose driven applications that encompass and address the social, cultural and ethical considerations.

This brings us to the methods we need to use to impart the information to our students. We need to feed the information about computer literacy in small and understandable bites instead of cramming so much information into one-semester courses that they cannot remember why they took the course in the first place. We need to make better use of the classroom and find

ways to actually teach them the things they need to know instead of the things we have been teaching semester after semester that only shows them the "how" but not the "why" or "benefit". The old "Open/File" and "Close/File" approach has got to go. A new way of teaching needs to be developed. We need to ditch the old-style concepts of rote learning and develop new ways to deal with the new technology that prize engagement, creativity, problem solving and a sense of social and cultural responsibility; 21st century approaches are needed to teach 21st century concepts.

5. New Teaching Model

Making use of the classroom time is critical in the new teaching methods. Looking at the model in Figure 1, note that ten major items taught in the classroom in the past have been moved from the classroom to a periphery location. They are no longer taught as such in the classroom. The items are now taught outside the classroom in a variety of ways in which the students can access on an as-needed basis. We need to develop ways to teach these ten items in ways that do not involve classroom time. This can be accomplished in numerous ways.

The majority of the items are self-explanatory. For example, Wikis can be used on Blackboard to stimulate discussions on almost any subject. This would take place outside the classroom. The same can be said for the Web, Books, Vodcasts, Blogs, Listservs. Interactive Presentations can be posted on the Web or Blackboard. Interaction and Activities are things that can originate outside the classroom and depending on the topic, may become part of the classroom dialog. The same can be said for any of the periphery items. The original topic could even originate in the classroom and the discussion may be continued through Blogs for instance to stimulate student involvement. Many students are hesitant to take part in a classroom discussion for fear of "being made fun of" or just fear of speaking in front of others. These students would be able to take part in the discussion through the activities outside the classroom and still have their viewpoints known on a particular topic. It would allow them to feel a part of the class without having to "stand and deliver".

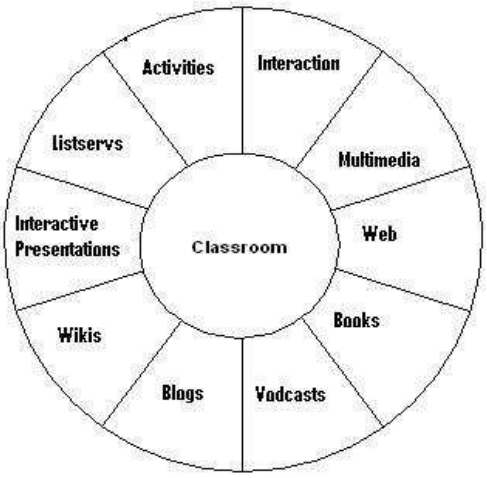

Figure 1

6. Questions for Thought

The following four questions were asked of eleven students at the beginning of the computer literacy class. Their responses seem to suggest that students who come into the class with a clear superficial understanding are uncertain as to how to apply technology to their everyday lives. The authors are not suggesting that this is a reliable or representative survey, merely an indication that further examination needs to be conducted.

The four questions are as follows:

1. You have just seen the film "300" and you have become fascinated with Spartan fighting styles. You decide to use the Internet to research Spartan fighting styles. Before you start your search you want to plan your approach. What keywords and in what combination and what order do you use to obtain the information? What search engines or systems are you going to use? How do you justify your choice? How do you evaluate the quality of information you receive?
2. You bought a CD of the Beatles album 'Abbey Road'. Your friend has an old LP of the same album but it is severely scratched and in any case, she no longer has a record player.

The friend asks for you to burn her a copy of the CD. Would you agree to the request? Is it the right thing to do? Are you breaking the law?

3. You are connected to the Internet at home through a commercial ISP. The ISP runs a spam filter and virus protection, and provides a firewall for your on-line security. Are you safe? What additional measures would you put in place to provide you with a secure on-line experience?

4. What technology related skills are the most important ones to have? Explain and justify your answer.

Question 1

Of the eleven responses, 9 mentioned Google, one mentioned Yahoo and one was unable to identify a search engine. Only two of the responses identified more than one search engine. Nine responses used a single word or phrase in their search strategy. Three of the responses would use the domain name of the resulting web site as an indicator of quality and one response would compare results for consistency. The others did not provide a means for evaluating quality.

Question 2

Only two of the respondents would not burn the CD for her friend, one because it is illegal and one because, even though it is legal, they didn't have the skills to do it. Two were not sure if they were breaking the law. Of those that were willing to burn the CD, three gave no rationale for doing so, one justified the action because the friend had legally purchased the album in a different format, and the remainder valued the friendship more than the law.

Question 3

Four of the eleven thought they were safe, and three did not know enough to be able to provide an answer, including "I do not know what to do" and "I'm not sure. My Dad does that". The remaining four offered suggestions such as additional firewalls or virus protection. Only one respondent suggested not putting personal information in electronic communication and one mentioned encryption.

Question 4

The responses to this question were evenly split with about half suggesting that typing was the most important skill. The remaining respondents thought that familiarity with a range of software, including office software, multimedia and Internet security applications was important.

7. Dispelling Myths

There seems to be at least 4 myths that prevail in society today in the realm of teaching computer literacy. They are:

1. Schools teach technology literacy
2. Universities do not need to teach technology literacy
3. A 'one-size-fits-all' curriculum works
4. We have the time to teach everything to everybody.

Looking at them one at the time let us take the first: "Schools teach technology literacy". Nothing could be further from the truth. Granted, most high schools have some sort of computer class. However, looking at the curriculum taught (e.g. Texas Tech On-line BCIS course) and the lack of a required subject specific IT certification qualifications for teachers, we can only come to the conclusion that the quality of instruction and learning is at best variable. It becomes evident when the students are asked to perform simple tasks using the technology they were "exposed" to and are unable to complete the task in a professional manner, in many cases, failing to complete the task at all.

The second myth "Universities do not need to teach technology literacy" brings us to the question, "If the high schools are not teaching the technology required and the universities do not teach it, where will the students get the training? It has been shown that when students reach the university level they are not fluent in using technology (Shannon). The universities are responsible for teaching students more than technology mechanics. The appropriate and effective use of technology to solve problems goes beyond skills acquisition.

A third myth, "A 'one-size-fits-all' curriculum works", does not hold true for several reasons, but primary among them is that stu-

dents come into college with different backgrounds and aspirations and leave in different directions. That one experience cannot meet the needs of such a diverse group is self evident.

The fourth myth, "We have the time to teach everything to everybody", is a real fallacy. Most universities devote only one semester to a computer literacy course believing that will be sufficient. It is almost impossible to cram everything in a one semester course in a manner that is beneficial to the students. Most come away learning only one or two things well. Computer literacy needs to be expanded in the curriculum so that the students not only learn some of the basics but also how technology can be of service to them in their future. Whether one thinks that computer technology is wonderful or is the bane of modern existence, really does not matter. The technology is what is driving our society and in order to be a fully functioning member of society, one needs to be able to do more than "just the basics of writing a letter in Word, e-mailing, playing games and surfing the Web". A student needs to learn how to critique the information, use the technology to find the correct information, be able to tell the difference between information and misinformation, and above all, keep their information safe.

8. Conclusion

So where do we go from here? Do we just "plug along in a fog" or do we actively pursue ways to make sure that out students are prepared for the technological world in which we live? We must find ways to make sure that students are well-grounded in the things that technology offers. Does this mean that we require them to accomplish more outside the classroom as is illustrated in Figure 1? Does this bring us to the conclusion that maybe we need to expand the computer literacy from a one-semester course to a two-semester course? Does this mean that we need to change the requirements to get a teaching certificate to make sure that teachers in the lower grades and high school are trained to teach computer technology by taking more that a one-semester course that just teaches them Microsoft Office? These and a thousand other questions are begging for an answer. It is our job as educators to prepare our students for a wired world. So far, it seems that we are failing miserably.

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