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Using Stories to Promote Technological Literacy

Abstract

Technologies are all around us; they exist in many different forms; and have numerous diverse functions. Today's society, in general, would have a difficult time living or functioning without most of these modern conveniences. Yet people take our modern technologies for granted. That is, people use them but in almost every case do not really understand them, know how they work, or how they came to be. They are simply the tools utilized to accomplish a host of tasks and people accept them as such. However, technologies have been used by humans since the beginning of time to enhance and extend our capabilities. These technologies were then passed on from one generation to the next though verbal training sessions. Stories were used to demonstrate how these devices were first created, improved over time, and used. They added both breadth and depth to the training process. This use of stories to describe the innovation from the initial idea, to the creation of the first prototype, through its improvements, to its current state was an integral part of the learning process. All too often today this aspect of technological literacy has been sidelined in order to get to the facts, cover only the necessary information, and speed up the educational pace. However, as a result, the connection between today's technologies and those of the past is lost. In order to address this issue, stories from the ancient to recent past along with real life experiences have been incorporated into class lectures to explore and discuss the historical perspective of technological development. These stories also demonstrate how technologies are inter-related and how cultural factors affect the acceptance or rejection of technologies. The intent was to enhance the student's understanding of how technologies were developed and why. These stories promote technological literacy and help to prepare students for the technological challenges they will encounter in the future by enhancing and extending their understanding of past technologies and their related issues.

Introduction

In our modern society, everyone uses a wide variety of technologies on a daily basis. However, it may seem hard to believe but most people have little understanding of the nature of technology. They simply use the technology or the product in which the technology is embedded without any knowledge of how it works, where it came from, or how it evolved. Yet most consumers consider themselves to be knowledgeable of technology, when in actuality they are merely the users of technology.

Technologies were created or invented and then refined and improved over time to meet the ever changing wants and needs of its users. This progression of technology, as important to civilization as it was, is largely unknown to modern society. Few people, especially the younger generations, take the time or make the effort to understand the true nature of technology.

In order to rectify this situation an interdisciplinary course, TECH 393: Technology in World Civilization (Loendorf[7], 2010) was created a number of years ago. This junior level course explores a historical perspective of the development of technology in a global context by tracing

the interconnected events and cultures in which technology developed. It investigates how technologies are inter-related and how cultural factors affect the acceptance or rejection of technology. The course's main objective was to enhance the student's understanding of how technologies developed and why.

This interdisciplinary course satisfies the University's International Studies graduation requirement. As a result, students from all disciplines across campus regularly take the course leading to a great diversity of backgrounds and specialties. Even though the course is facilitated by engineering professors and all engineering and technology majors are required to take it, the course's content is targeted at all students regardless of their major.

Just like technology, the course makeup and content is always evolving and changing. Initially the teaching methods included lectures, discussions, videos, exams, and written projects (Loendorf[6], 2004). Over time the teaching methods have been expanded to include recreated artifacts (Loendorf & Geyer[9], 2008), demonstrations (Loendorf & Geyer[10], 2009), other collections of technologies (Loendorf & Geyer[11], 2010), and innovative visual content (Loendorf[8], 2011).

An additional teaching method was incorporated right from the very beginnings of the course but was so tightly integrated into the course that it was almost overlooked. That method was storytelling. Stories with a historical perspective as well as personal experiences about technology are intertwined throughout the entire course. These stories, in many ways, help the student to understand and recognize our dependence on technology, its origin, evolution, and its invasive nature into our lives.

Theoretical or Conceptual Support

A survey of 256 students that completed a freshman level general studies technological literacy course, designed to expose students to different technologies, was recently conducted. It revealed that for 64% of the students it was the first time that they had actually studied technology (Ritz[16], 2011). In addition, "the first-year statistics for this study indicated that this number was as high as 70%. Students found that technology does have an impact on the world in which they live" (Ritz[16], 2011). It also was noted that "students gained improved understandings of the effects of technology, a working knowledge of technology, and technology and careers" (Ritz[16], 2011).

"In the broadest sense, technology is the process by which humans modify nature to meet their needs and wants" (Young, Cole, & Denton[22], 2003). But over time this has led to a type of technological paradox. That is, as Pearson and Young[14] (2002) noted, as technology has become more important and critical to our daily lives, it has actually disappeared from our sight and became mostly invisible. Then adding to the dilemma "there is a lack of research on student conceptions about the nature of technology," (DiGironimo[2], 2011). As a result "adults and children alike have a poor understanding of the essential characteristics of technology, how it influences society, and how people can and do affect its development" (Young, Cole, & Denton[22], 2003).

This lack of understanding of technologies, both past and present, is directly related to enhancing not only the student's but society's technological literacy level. "Technological literacy can be thought of a comprising three interrelated dimensions that help describe the characteristics of a technologically literate person... (1) knowledge; (2) ways of thinking and acting; and (3) capabilities" (National Academy of Engineering[12], 2008). "Technological literacy is the ability to use, manage, assess, and understand technology" (International Technology Educational Association[4], 2007). In order to be technologically literate four competencies or abilities are required: "(a) accommodate and cope with rapid and continuous technological change, (b) generate creative and innovative solutions for technological problems, (c) act through technological knowledge both effectively and efficiently, and (d) assess technology and its involvement with the human life world judiciously" (Wonacott[21], 2001).

"Artifacts are probably our most obvious everyday encounter with technology. Therefore, a good understanding of the nature of technical artifacts is a relevant part of technological literacy" (Frederik, Sonneveld, & Vries[3], 2011). Students can learn a great deal from studying artifacts whether they are from the recent or ancient past. However, ancient artifacts are difficult to find and are usually very expensive. One affordable way to utilize ancient artifacts is to recreate them using the original tools and methods as was done by Loendorf and Geyer[9, 10] (2008, 2009). Another way is to form collections of artifacts (Loendorf & Geyer[11], 2010) from the past that can be displayed and examined (Loendorf[8], 2011).

Another useful tool that can be utilized effectively to promote technological literacy is the telling of stories. "Storytelling or, more formally, oral narrative is defined as the verbal presentation of a series of events meaningfully connected in a temporal and causal way" (Onega Jaén & García Landa[13], 1996). Denning[1] (2005) calls stories doorways, gateways, or portals through which "we can expand our lives and learn about other worlds. They offer guideposts to what is important in life. They generate meaning. They embody our views. They give us the clues from which we can discover what ultimately matters."

The ancient art of storytelling has been used for educational purposes since the beginning of verbal communication. Listening to a well told tale encourages students to think and use their imaginations. For example, the American Indians do not have an extensive written history, but they do have a rich storytelling tradition. In fact, the story of their heritage is preserved primarily through this storytelling tradition.

Ransome[15] (1909) relates that storytelling probably first consisted of simple chants that praised the dawn, expressed the joy of being alive, and were used to ease the drudgery and boredom of laborious tasks. Later the storyteller became the community entertainer by combining their stories with poetry, music, and dance. The storyteller also evolved into the group historian. This was the beginning of professional storytelling.

Stories "can be used to persuade, motivate, and inspire in ways that cold facts, bullet points and directives can't," (Simmons[17], 2006). Stories are a type of pull strategy. "If your story is good enough, people – of their own free will – come to the conclusion they can trust you and the message you bring," (Simmons[17], 2006). In addition, "storytelling transports people to different points of view so they can reinterpret or reframe what your 'facts' mean to them," (Simmons[18],

2007). This leads to an interesting conclusion. "Every problem in the world can be addressed – solved, made bearable, even eliminated – with better storytelling," (Simmons[18], 2007).

There is nothing quite so gripping, invigorating, or informative as a good story that is well told. And even when the subject is a historical or technological narrative, this conclusion holds true. "When you tell a story, however, you must always be there, shaping the artistic moment, … balancing the demands of the story, your needs, and the needs of the audience," (Lipman[5], 1999). A well developed and presented story will capture the student's interest, reach its listeners, and be remembered long after other orations like typical lectures.

Telling Stories About Technology

Stories that describe the historical aspects of technology are embedded directly into every lecture in order to gain and keep the students attention and boost their interest. The sources of these stories are quite varied ranging from historical texts and personal experiences. Some of the stories are well scripted while others are not. But it is the verbal presentation of these stories that really makes an impact upon the students. That cannot, in most cases, be duplicated by the written word alone. With this in mind, three examples of typical stories told about technology will be presented.

The first story relates to a technology used by virtually every student and that is automobiles. The particular technology of interest here is the engine type that powers the vehicle. This story was adopted, adapted, and expanded from a concept by Teich[19] (2008) and titled by the author of this paper as "The Better Technology."

<div align="center">The Better Technology</div>

In the early 1900's, gas-powered cars shared the roads with those powered steam engines, such as the well known Stanley Steamer's. Another small player was the electric cars. Eventually, internal combustion engines captured the market and the old steamers disappeared. But why? The usual assumption is that the two contenders went head to head and the best technology won. But there is a lot more to the story. Although the internal combustion engine did have some advantages in performance and convenience, steam-powered cars had their own pluses: They had no transmission or shifting of gears, they were simpler to build, and they were smoother and quieter to operate. Experts then and now have called it a draw! The "better" technology was mostly a matter of opinion.

Instead, the steamers were killed off by several factors that had little or nothing to do with their engineering merits. For one, the Stanley brothers, builders of the best steam-powered cars of the time, had little interest in mass production. They were content to sell a few cars at high prices to people who could appreciate their superiority. Meanwhile, Henry Ford and other Detroit automakers were flooding the country with inexpensive gas-powered cars.

The steamers might well have survived as high-end specialty cars were it not for a series of unlucky breaks. At one point, an outbreak of hoof-and-mouth disease caused public

horse troughs to be drained, removing a major source of water for refilling the car's boilers. It took the Stanley brothers three years to develop a closed-cycle steam engine that didn't need constant refilling. But by then World War I had begun, bringing strict government limits on the number of cars that businesses could build for the consumer market. The Stanley Company never recovered, and it folded a few years later. The remnants of the steam automobile industry died during the Great Depression, when the market for high-priced cars all but disappeared. [Author's additions to the story.]

The second example story examines the winners and losers of technological change. As new technologies are developed they, in many cases, replace an already existing technology. The consequences of this change can be devastating to people and entire communities on the losing side and lead to prosperity for the people and their communities on the winning side. This story was adopted, adapted, and expanded from one by Volti[20] (2009) and titled by the author of this paper as "Winners and Losers."

Winners and Losers

"Primitive" people are often thought of as the only losers when it comes to technological change. However, they are not the only ones subject to the unpleasant consequences of technological change. On occasion, technological advance has fatally disrupted modern communities and the people living in them. Consider the city of Caliente, Nevada that was supported by a single industry: the servicing of steam locomotives. It was an important division point on a transcontinental railroad, and many of the town's people worked as machinists, boilermakers, and repairman. Their incomes supported the town's civic and commercial establishments (schools, churches, hospital, theater, restaurant, grocery, hardware, variety, and other stores).

Then, in the late 1940's, the diesel-electric locomotive rapidly replaced the steam locomotive. Diesels required less frequent servicing and when it was required it took place in large centralized shops. As a result, service facilities at division points were eliminated. The town lost its economic base, and within a few years it had become a shell of its former self. People moved out, homes were abandoned, and shops were boarded up. The tragedy of this small town has been repeated in many other communities affected by technological change. Many places of employment have closed down as new products and processes have replaced old ones, leaving communities and their inhabitants in desperate straits.

Now consider another city, Kenosha, Wisconsin. The economy of Kenosha was also primarily supported by one big employer, the American Motors Corporation (AMC). They were the fourth largest automobile manufacturer in the United States at the time producing vehicles with names like Nash, Rambler, Javelin, Gremlin, AMX, and Jeep. Then in 1987, the Chrysler Corporation bought out AMC. The facilities remained open for a couple of years before they were all shut down. The city became a virtual ghost town with no jobs, no way to sell your house, and no hope. Then the city managers acted in a very proactive way. They went all over America and recruited small companies with 10 to 20 workers and convinced them to move to Kenosha. Many of these companies did

exactly that and have since grown and prospered. Today Kenosha has a vibrant economy that is no longer tied to one big business but to many smaller ones. The city transformed itself and became a winner rather than a loser of technological change. [Author's additions to the story.]

The third example investigates competing technologies that appeared on the market about the same time. In this case, consumers have to make the difficult choice of which one to buy. The consequences of this decision could lead to owning an obsolete and outdated technology or being at the leading edge of a new promising technology. Consumers vote for products when they reach into their pockets and pull out their money to purchase them. This vote of confidence makes some products very successful as they fly off store shelves and others failures as they sit there and gather dust. This story was adopted, adapted, and expanded from comments by Teich[19] (2008) and titled by the author of this paper as "Dueling Technologies."

Dueling Technologies

Why did VHS cassette recorders win over Betamax? Even when most experts (and many non-experts) agreed that Betamax was the better technology with the sharper picture. The two formats for storing video and audio on magnetic tape came on the market around the same time. However, they were incompatible, so consumers had to choose one or the other. Initially, video rental stores shared shelf space equally between the competing formats. But that all changed when VHS gained a small lead, perhaps because of better marketing, perhaps because it used six-hour cassettes instead of Betamax's five, or perhaps for other reasons. Then gradually video rental stores began to stock more VHS tapes than Betamax tapes. This led people to buy more VHS machines and started a self-reinforcing cycle that, in a few years, made Betamax as obsolete as eight-track audio players.

This same scenario has repeatedly played out since then with numerous new technologies. Among them are the standards for High Definition Television (HD TV), the new format for DVD's, the specifications for Satellite Radio, and many others. This process will likely continue as long as new technologies are developed and introduced into the market. Some will become wildly successful as society readily accepts and adopts them while others will rapidly fade away as just another failed technology that was never accepted. [Author's additions to the story.]

These stories do far more than just illustrate the competitive nature of technological change. They leave the listener with a lasting memory and an easy way to remember the various aspects of technological literacy. Before the written word, all aspects of history and life were remembered as stories. Today stories are being used successfully to rekindle and remind students that past and even ancient technologies still have an impact on their lives in many ways. As a result, the use of stories has become an integral part of promoting technological literacy.

Evaluation and Assessment

The primary objectives of technological literacy are to provide people with the tools to participate intelligently in the world around them. In general, it encompasses three interdependent dimensions: "(1) knowledge; (2) ways of thinking and acting; and (3) capabilities" (National Academy of Engineering[12], 2008). In order to assess and evaluate the value of storytelling as an effective technological literacy tool, a short survey instrument was used that contained four questions and an area for comments. The four questions utilize a 5-point scale where 5 = excellent, 4 = good, 3 = average, 2 = poor, and 1 = very poor. The four questions used are:
1. The course as a whole was…,
2. The course content was…,
3. The instructor's contribution by storytelling in the course was…, and
4. The instructor's effectiveness in telling stories about the subject matter was….

The results from this evaluation and assessment process for two courses facilitated during the last academic year are shown in Table 1. All of these courses were conducted during the Spring or Summer Quarters of 2011. The number of participants along with the average scores for each question is displayed by course. In addition, the average score of the four questions per course is also revealed. Finally, the overall average score for the two courses is presented.

Table 1
Results of the Storytelling Course Assessment

	Spring 2011	Summer 2011
Number of Students in Class	34	25
Question 1 Class Average	4.50	4.64
Question 2 Class Average	4.59	4.63
Question 3 Class Average	4.74	4.88
Question 4 Class Average	4.74	4.86
Overall Class Average	4.64	4.75
Total Assessment Average		4.69

For this study, 59 students have participated in this storytelling aspect of technological literacy evaluation. All of the average assessment scores by course for all four questions exceeded the good criteria and approached the excellent category. Since an overall average of 5 for excellent is highly unlikely, average class scores of 4.50 and above along with a total assessment average score of 4.69 is very good. It reflects that using storytelling to promote technological literacy is meeting its objectives and succeeding.

The evaluation tool also offered the opportunity for making comments on the way the course was facilitated. A number of relevant comments were received offering further insight into the way

that stories were used to enhance the material covered. Some representative student comments included:

1. Instructor used his experience in engineering to relate real-life stories and examples.
2. Instructor did an excellent job of keeping the class engaged, interested and enlightened through the use of stories.
3. Instructor always had interesting and relevant stories to tell.
4. His stories made this class really enjoyable and created involvement.
5. I learned a lot and the instructor told great stories.
6. He had an interesting way of telling stories from his experiences in the field with technology.
7. He is a very engaging speaker as he tells stories.
8. The stories were interesting, informative, and enjoyable.
9. The instructor's stories were very memorable.
10. Great class content and an awesome class.

The results from the evaluation and assessment process are very encouraging. They are taken seriously and are used to improve the effectiveness and impact of this course on technological literacy. The results indicate that using different and innovative teaching methods is having a positive impact and presenting technological literacy in a very interesting and informative manner. However, new innovations in teaching techniques and methods will be tried to improve the effectiveness and reach of the project. In the end, it is all about continuous improvement.

Lessons Learned

Using stories to promote technological literacy led to a number of valuable lessons learned. The use of stories helped students better understand the impact and importance of technologies on society throughout the ages by adding a new dimension to their learning experience. This old but very effective teaching method fostered an enhanced educational atmosphere that was well received by the students. As a result, they were more attentive, interested, and engaged in the course.

Storytelling also has a host of other benefits for the students. It can promote improved listening skills and encourage action. It can offer insights into different technologies and relate diversity in cultures from around the world and time periods. It exposes students to different traditions and values. It encourages students to use their imagination and creativity as well as consider new ideas. It enhances critical thinking while making historical information in the form of stories easy to remember.

Storytelling was a refreshing way to break the classic mold of lecture based courses. It offered the opportunity for the facilitator to be more creative and entertaining during oral presentations. It not only made the lectures more fun and less boring for the students but for the instructor as well. The use of stories also allowed for a more open, relaxed, and free format that the students responded to very positively.

Stories are more than likely used by every instructor in nearly every college course. However, it is such a common way of teaching that it has become essentially transparent and like anything

invisible it is no longer noticed. Facilitators use the power of storytelling as an instinctive behavior acquired from childhood that they have used throughout their lives. It has become part of all our lives and is a tool that we constantly utilize simply because it works.

New and innovative teaching methods are continually being considered and tried to promote technological literacy, student success, and retention. To date all of these attempts have met with improved student interest, attentiveness, and concentration. New approaches are currently being designed and the implementation phase is not far off. This quest will persist.

Conclusions, Reflections, and the Future

Realizing that stories are still a very valuable component of the learning process, they have helped students understand that technology has changed society and that society has changed technology. It is in many ways a back and forth type of arrangement that is similar to the relationship between science and technology. Stories played a big part in this learning process.

Looking back and reflecting on the use of stories to promote technological literacy reveals significant benefits to the students. The results indicate an increased student participation, awareness, interest, and retention of just how technology has evolved. In addition, it has made the class more enjoyable and memorable for all.

In the future, new techniques and methods will be considered and implemented to enhance student learning in the context of technological literacy. They will lead to improved student understanding of past technological issues that can then be used to address future challenging and competitive situations. Just what they are or will be is still a surprise that will be revealed sometime in the future.

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