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## Demystifying Technology for ALL Learners

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## **Abstract**

Some researchers have begun to call into question the dominant rhetoric and policies regarding the digital divide as an oversimplification missing deeper social and institutionalized inequalities that form the root of what might be termed a “people divide” (Luyt, 2004; Eubanks, 2011). The distributive paradigm in relation to the digital divide has its roots in a value system of technocentrism – a belief in technology’s ability to control and protect the environment (Papert, 1987). Instead, new frameworks such as digital inclusion (IMLS, 2012) and cognitive justice and critical citizenship (Eubanks, 2011) inform this work. Core to these complementary frameworks is the emphasis on community-wide participation in planning, creation, and implementation. To advance such broad participation, new educational pedagogies for digital literacy and computational thinking are needed for all participants to become more critical technological citizens. Our approach, which we call Demystifying Technology, is grounded in progressive education that bring teachers and students into a space of mutual learning around problems of relevance to participants’ everyday lives (Dewey, 1938). The purpose of the current project is to expand the pilot of these Demystifying Technology workshops and to initiate a more formal evaluation of the approach, resulting in a template for others to incorporate components of Demystifying Technology workshops into their digital literacy programs.



## Introduction

Technology and the human condition are deeply intertwined. As tools, technologies are used to help us meet our basic physiological and safety needs. They are also often central to our meeting of higher needs, serving as tools to communicate with friends and family, to problem solve, and to accomplish creative endeavors. However, too often technology is presented within a technological determinist framework and technocentric value system. Technocentrism is a belief in technology's ability to control and protect the environment (Papert, 1987). Technological determinism views technology as a neutral artifact, developed under its own laws as an autonomous system limited only by the current state of scientific knowledge. Adoption is non-negotiable and irrevocable. Those individuals, communities, and societies that adopt an innovation become more efficient, while those that do not will fall behind. As early adopters of an emerging technology, we gain a competitive advantage, while traditionalists lag behind (Rogers, 2003; Winner, 1986; 1997).

Access to information and communications technology is indeed important for individuals to fully achieve educational and economic development goals. Lack of access has been termed the "digital divide" (NTIA, 1999). However, some researchers have begun to call into question the dominant rhetoric and policies regarding the digital divide as an oversimplification missing deeper social and institutionalized inequalities that form the root of what might be termed a "people divide" (Luyt, 2004; Eubanks, 2011). Too often technocentrism and technological determinism permeate the policies and research of the distributive paradigm in relation to the digital divide. As Eubanks (2011) states: "If technological innovation is synonymous with progress, then the distribution of the products of that innovation becomes a major social justice goal."

However, embedded within technological determinism and technocentrism is a passive approach to technology – individuals and society adapt to technology rather than considering how we exercise agency to shape the technology (MacKenzie and Wajcman, 1999). We fail to recognize the skills, strengths, and resources that people have to share no matter the technological wherewithal they may have (Eubanks, 2011). We further miss opportunities to assess the social systems that influence the design, production, and distribution of a technology, thereby failing to critically consider the social, political, and economic qualities embedded within that technology (MacKenzie and Wajcman, 1999; Williams and Edge, 1996; Winner, 1986). Without such assessment, we cannot make fully informed strategic decisions regarding which technologies might more effectively serve as tools to achieve our individual and community development goals. This leads to a sociotechnical gap between what the technologies do and what society wants (Whitworth, 2009).

While no one is safe from occasionally falling into the technocentrism trap, those most vulnerable to it are those with limited technical understanding. They miss that what is thought to be a property of the technology is actually a cultural construct. However, such misunderstanding is not readily addressed simply by providing a deeper technical understanding of how the computer really works, but requires a deeper systems understanding not unlike that required to understand the root of sexist or racist stereotypes (Papert, 1987).

## **Demystifying Technology Workshops**

To challenge technological determinism and technocentrism, we have been developing an alternative pedagogy for digital literacy and computational thinking that we call Demystifying Technology. Our workshops adopt the alternative critical interpretive sociotechnical approach (Rhinesmith and Wolske, 2015) to technical artifacts, advancing understanding of technology as both being shaped by social systems and also used as a “cultural building material” (Papert, 1987) by individuals and communities to shape society (MacKenzie and Wajcman, 1999). Users actively create technology by rethinking meaning and use within the current context. Technology is no longer a static artifact that is understood by its constituent parts, but a situated innovation-in-use with emergent properties that arise through dynamic interactions of the social context with the technology artifact (Whitworth, 2009; Bruce et al., 2009).

To achieve pedagogical goals, the Demystifying Technology workshops adopt a progressive education approach to experiential learning (Dewey, 1938). Instructors serve as guides to embed learning about technology within the larger community development goals of the students, helping them to shape design choices by integrating their impulses, past experiences, and community knowledge (Wolske et al., 2014). Students do not just learn how the parts of a computer or network fit together, they learn how selecting one technology over another is to also choose certain embedded social and political qualities, and how such choices may subsequently impact others in their community negatively or positively.

Such critical technological citizenship education does not, nor should not, require a formal philosophical education to participate, but instead benefits from the everyday lived experiences of all learners (Eubanks, 2011). Indeed, even the most elementary lesson on technology results in collateral learning regarding technocentrism or critical interpretive sociotechnical values. For instance, consider a frustrated learner trying to first develop typing skills on a traditional US keyboard. A technocentric approach is to pat the learner on the shoulder and to encourage them to stick with it, that they will eventually get it. This collateral lesson is that the technology is unquestionable and that learner is deficient. A critical interpretive sociotechnical approach is to ask the learner why they might be struggling; the learner might respond that the letters are all scrambled in a random order. A quick aside might then point out that the “QWERTY” keyboard was designed to meet the needs of late 1800’s typewriters which might jam if keys were more human friendly. Because the QWERTY keyboard has become so embedded within our society, we are left learning to use a less than optimal technology (Stamp, 2013). In so answering, the student’s frustration is recognized as legitimate, but they are also given an early insight into ways in which cultural context is embedded within a technological artifact. They are further given an insight into the sociotechnical gap between what they want to do and what the technology does in ways that might eventually lead to problem posing and design thinking, even if these specific terms and phrases are not used.

By incorporating questioning, research, and individual and group reflection into even the most basic of lessons, we seek to bring different participants’ insights and resources together to develop aspirational outcomes such as self-efficacy and agency through collective knowledge building. By adopting experiential, progressive pedagogy, we work to not only advance digital literacy but also computational thinking, which the International Society of Technology in

Education (ISTE) and the Computer Science Teachers Association (CSTA) has operationalized as:

*“Formulating problems in a way that enables us to use a computer and other tools to help solve them; logically organizing and analyzing data; representing data through abstractions such as models and simulations; automating solutions through algorithmic thinking (a series of ordered steps); identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combinations of steps and resources; and generalizing and transferring this problem solving process to a wide variety of problems.” (ISTE and CSTA, 2011)*

The Demystifying Technology workshop was first piloted at The Urbana Free Library in late spring 2013. During the summer of 2013, in conversations Kenwood elementary school, we considered how the workshops might advance the school’s vision of “technology and literacy for the community,” helping the school bridge the home/school divide to invite parents from low socio-economic status households into collaboration with school teachers to further the computational-thinking education of their children. During fall 2013, we piloted two Demystifying Technology workshops with parents (September 2013) and families (December 2013).

### **Objectives**

Our objective for spring 2014 was to further develop the Demystifying Technology workshop as an alternative model for digital literacy and computational thinking, to create and test a template for the workshops that can support implementation of the workshops by other trainers, and to begin a formal evaluation of these workshops to answer the following research questions:

- How do participants integrate their personal backgrounds with the material covered in the workshops to achieve aspirational outcomes such as self-efficacy and agency?
- What social practices emerge or change as the Demystifying Technology workshops are integrated into different settings?
- How should the Demystifying Technology workshops be changed in order to achieve educational goals?
- What lessons can be learned about scaling in order to make the Demystifying Technology workshops meaningful and sustainable in a variety of settings?

At the core of our objectives is building a more inclusive sustainable digital community. Digital inclusion is the ability for all individuals and groups to access and effectively use information and communication technologies. Sustainable digital communities are not built from the outside in, but through involvement of all sectors of the community, any one of which may provide leadership and the catalyst for action (IMLS, 2012). It is also important to consider the ethical implications surrounding the selection, use, and recycling of electronics. Electronics can be a powerful tool for social change, but can also serve to reinforce social inequities (Winner, 1986;

Luyt, 2004; Eubanks, 2011), with environmental and human rights impacts falling most heavily upon those with the lowest socio-economic status (Hunt, 2010). Our objective is to encourage more ethical social practices amongst all in the community, and to especially engage those most at risk of being left out of and negatively impacted by emerging digital communities.

## Methods

Students in the principal investigator's Community Informatics Studio course collaborated with school librarians at Kenwood Elementary and Jefferson Middle School in Champaign to develop additional iterations of the Demystifying Technology workshops. Further, one team of students worked to develop a template based on the past pilots and current semester work. Importantly, Kenwood administrators have recognized that their teachers would benefit from participating in a Demystifying Technology workshop, and that parents would benefit from introduction to the peer learning/progressive education pedagogy used at the school. Therefore, the administration asked that we conduct a Demystifying Technology workshop that included both teachers and parents who had participated in past workshops so as to expand learning of technology within social systems, advance learning regarding progressive education, and to build deeper collaborations between teachers and parents. Kenwood administration and librarians also suggested a series of Demystifying Technology mini-workshops with students that might result in students creating their own workshop design to be delivered by the students to teach their parents and teachers on one aspect of technology. Families who participated in workshops were asked to take home a computer they helped refurbish during the Demystifying Technology workshops to allow them to further explore ways to more effectively use educational programs with their children, and to share their lessons learned with teachers.

A situated evaluation approach was used in the evaluation of these workshops. Bruce et al. (2009) state:

*“A situated evaluation approach conceives technology users as active creators, rather than as ‘passive recipients of technological products and scientific knowledge’ (Eglash, 2004). Users actively rethink the meaning and use of a technology and reinvent its practices by appropriating them within their situated, cultural contexts.”*

Situated evaluation is complementary to formative and summative evaluations. However, rather than focusing on the *innovation and its* effects as the central point of study, it focuses on the social practices that develop through active contribution of workshop participants as creators of new knowledge and practice in and following the workshops. In our case, we used it to learn how workshop participants change their use of technology to achieve educational goals. The Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003) was used as a model to inform our situated evaluation. Pre- and post-questionnaires were used to collect immediate feedback regarding personal experiences with technology, personal learning outcomes, and the effectiveness of different workshop components to advance personal objectives. Structured interviews and observations were used to provide additional qualitative insights into how participants interacted with material covered in the workshops to affect practices. Structured interviews were also used to understand social changes affected by workshop participants (e.g., increased collaboration of parents with teachers in the education of their children) observed by host organizations.



## Results

During spring 2014, students from the Community Informatics Studio supported third and fifth grade students at Kenwood Elementary School in Champaign to (1) learn eToys/Scratch and to participate in informal Demystifying Technology activities within their classrooms, (2) create a student advisory committee who subsequently participated in the redesign of the school library at Jefferson Middle School in Champaign, and (3) develop a new template to document new Demystifying Technology modules (available online at: <http://prairienet.org/op/demystifying/learning-adventure-modules/>).

Two Community Informatics Studio students returned after the end of the semester to provide support for a formal Demystifying Technology workshop with 13 parents and teachers from Kenwood Elementary School held Saturday, May 3 and Saturday, May 10 (Figures 1 and 2). A new workbook was developed for the formal Demystifying Technology workshop, and was subsequently also used to offer a weeklong Demystifying Technology workshop with 11 teens and 2 adults at Sunshine Cultural Arts Center in East St. Louis, IL. Combined, participants in the two formal Demystifying Technology workshops refurbished 28 computers, 13 of which went home with participants and 15 that were used to establish a public computing center at the Sunshine Cultural Arts Center (Figure 3).



Figure 1: Teachers and parents working on a software problem during the Demystifying Technology Workshop at Kenwood.



Figure 2: Martin Wolske provides answers to parents and teachers during the Demystifying Technology Workshop at Kenwood.



Figure 3: Finished Computer Lab at Sunshine Cultural Arts Center



Based on feedback following the two workshops, changes were made to the workbook. Version two of the workbook is available online at: <http://prairienet.org/op/demystifying/?p=471>.

A new pre- and post-workshop questionnaire was piloted during the formal Demystifying Technology programs held in May 2014 at Kenwood Elementary School. The questions and the percent of respondents indicating specific points along the Likert scale provided are included in Table 1.

Table 1: Pre-Workshop Questionnaire Results.

|   | Definitely | Maybe | Not Really | No idea or never tried |
|---|------------|-------|------------|------------------------|
| Q1: I am comfortable setting up a new computer and getting it ready for use   | 28.6%      | 57.1% | 0%         | 14.3%                  |
| Q2: I am comfortable installing new software on a computer  | 14.3%      | 14.3% | 57.1%      | 14.3%                  |
| Q3: I am comfortable starting a program like a word processor or web browser and doing things within that program   | 57.1%      | 28.6% | 14.3%      | 0%                     |
| Q4: I am comfortable exploring with my children how to use computer programs to learn better  | 57.1%      | 14.3% | 28.6%      | 0%                     |
| Q5: I am comfortable using Internet resources to support my daily activities  | 85.7%      | 14.3% | 0%         | 0%                     |
| Q6: I am comfortable getting one computer to talk to another computer or to the Internet  | 28.6%      | 28.6% | 28.6%      | 28.6%                  |
| Q7: I am comfortable knowing how to protect my personal privacy and securing my data  | 57.1%      | 14.3% | 28.6%      | 0%                     |
| Q8: When I am working on something at home or work, I have a pretty good sense of when and how to use computers and/or the Internet to help me, and when I should instead use non-digital tools or seek help face-to-face | 57.1%      | 28.6% | 0%         | 14.3%                  |
| Q9: I like to figure out new ways to do things using the stuff I have, or by trying out new stuff   | 85.7%      | 0%    | 14.3%      | 0%                     |
| Q10: People often ask me what I think of new things they are thinking of buying, or how to use new things they've just bought   | 14.3%      | 42.9% | 42.9%      | 0%                     |
| Q11: I think about who's getting helped and who's getting hurt when someone buys or uses a certain type of computer, program, or Internet service   | 14.3%      | 28.6% | 28.6%      | 28.6%                  |

A similar questionnaire was administered at the end of the workshop. Results are provided in Table 2.

Other results are more difficult to quantify. For instance, one parent reported that after participating in the workshops, her daughter came home with a new excitement regarding computers. She expressed a new interest in computer science as a possible career track and wanted to refurbish and install Linux on her home computer using a USB flash drive provided to her through this grant. An adult who participated in the Demystifying Technology workshops at Sunshine Cultural Arts Center in East St. Louis has asked if it might be possible for the principal investigator to return later in the summer to provide train-the-trainer workshops to other adults so that they might begin offering Demystifying Technology workshops regularly through the new computer lab at the center. In an interview immediately following the workshop at Kenwood, one teacher commented on the value of communities’ critical reflection on the ways technology is helping or hurting the goals of the community:

*“So as issues come up in our classroom, just using that as the framework – which, I think is wonderful. Explicitly saying, ‘This is a classroom community. What are our goals? What do – what do we have? What are we trying to do here?’ I love that.”*

Table 2: Post-Workshop Questionnaire Results.

|  | Definitely More | Maybe More | Not Really | No Idea |
|--|-----------------|------------|------------|---------|
| Q1: Because of this workshop, I am more comfortable setting up a new computer and getting it ready for use   | 66.7%           | 22.2%      | 0%         | 11.1%   |
| Q2: Because of this workshop, I am more comfortable installing new software on a computer  | 44.4%           | 44.4%      | 0%         | 44.4%   |
| Q3: Because of this workshop, I am more comfortable starting a program like a word processor or web browser and doing things within that program   | 55.6%           | 22.2%      | 22.2%      | 0%      |
| Q4: Because of this workshop, I am more comfortable exploring with my children how to use computer programs to learn better  | 66.7%           | 33.3%      | 0%         | 0%      |
| Q5: Because of this workshop, I am more comfortable using Internet resources to support my daily activities  | 77.8%           | 22.2%      | 0%         | 0%      |
| Q6: Because of this workshop, I am more comfortable getting one computer to talk to another computer or to the Internet  | 44.4%           | 44.4%      | 11.1%      | 0%      |
| Q7: Because of this workshop, I am more comfortable knowing how to protect my personal privacy and securing my data  | 66.7%           | 33.3%      | 0%         | 0%      |
| Q8: Because of this workshop, I have a better sense of when and how to use computers and/or the Internet to help me, and when I should instead use non-digital tools or seek help face-to-face   | 66.7%           | 22.2%      | 11.1%      | 0%      |
| Q9: Because of this workshop, I am more likely to try to figure out new ways to do things using the stuff I have, or to try out new stuff  | 55.6%           | 44.4%      | 0%         | 0%      |
| Q10: Because of this workshop, I have a better sense of how to answer people if they ask me what I think of new things they are thinking of buying, or how to use new things they’ve just bought | 55.6%           | 33.3%      | 11.1%      | 0%      |
| Q11: Because of this workshop, I will think more about who’s getting helped and who’s getting hurt when someone buys or uses a certain type of computer, program, or Internet service            | 66.7%           | 33.3%      | 0%         | 0%      |

## Discussion

The Demystifying Technology workshops continue to be well received, with each iteration demonstrating improvements based on feedback from previous participants and site hosts. Additional workshops were planned for The Urbana Free Library and Kenwood Elementary School for early August 2014. At Kenwood, the next step was to create Demystifying Technology workshop stations as part of a new afterschool open computer lab. The stations provided opportunities for self-paced explorations of computer hardware, software, and networking. Additional stations provided access to Raspberry Pi's, Scratch programming, and multimedia. The goal was to provide a flexible innovation space for students, parents, and teachers to practice computational thinking skills in a learning commons.

August 2014 workshops at The Urbana Free Library were planned explicitly to foster learning about computer hardware and software and to develop a sense of agency around Maker and Fab Lab equipment currently available to teens after school. It was hoped that this workshop could serve as a way to pilot extending hours of availability past the Teen Open Lab. Dorothea Kleine (2011) indicated the importance of advancing both educational and skill resources and also a sense of choice and action to foster capabilities related to information and communications technology. Results from the first pilots of our research indicate that although participants entered into the workshops with limited or no confidence working with hardware, software, and networks, they did demonstrate keen interest in trying new technologies or exploring new ways to do things using the materials they already had. When the questions were asked in a way that deemphasizes technology and instead emphasizes innovation, participants responded positively. This result provides a new understanding of the importance and focus of the Demystifying Technology workshops. Rather than framing the focus as developing innovation skills, these workshops help participants develop skills and recognize the ability they have to apply their innovative spirit to digital technologies. This objective is consistent with the overall goals of computational thinking for all approaches (ISTE and CSTA, 2011).

The post-workshop questionnaire and interviews are helpful to get an immediate sense of how participants responded to the material covered. But it will be important to conduct interviews in the coming months to determine ways in which the learning achieved during the workshops affected social practices. For instance, in response to the question that asked whether participants felt more comfortable installing new software after the workshop, an equal number of respondents replied definitely, maybe more, or no idea. This result is not surprising, as participants may need time to explore installation of software on their own before they increase their comfort in this task. But even more importantly, the motivation for Kenwood elementary to host the workshops was in order to bring parents, teachers, and students into a stronger collaboration to improve student learning outcomes. To answer the question, "What social practices emerge or change as the Demystifying Technology workshops are integrated into different settings?", it will be important to conduct subsequent interviews and classroom observations.

Critical technological citizenship education does not, nor should not require, a formal education to participate, but instead benefits from the everyday lived experiences of all learners (Eubanks, 2011). Indeed, even the most elementary lesson on technology results in collateral learning

(Dewey, 1938) regarding technocentrism or critical interpretive sociotechnical values (Rhinesmith and Wolske, 2015). Participants in the Demystifying Technology workshops quickly moved beyond being passive recipients of a banking model of education in which the instructor has all the critical knowledge to be distributed to the student to a problem-posing, popular education approach (Freire, 1993). Further, using Deweyan progressive educational pedagogy, they were encouraged to become active participants in a shared learning activity. When a problem was encountered, everyone was encouraged to share in the troubleshooting. After learning new concepts, everyone was encouraged to consider how this might affect his or her daily social practices. Participants were encouraged to see themselves as experts in the social components of sociotechnical artifact, to recognize their increasing technical expertise, and to appreciate their ability to co-create and re-create sociotechnical artifacts.

## Recommendations

The following three recommendations are the next immediate steps for the Demystifying Technology for ALL Learners project team:

1. Further develop the evaluation tool to guide in the development and scalability of the workshops and to assess its impact, particularly on changing social practices related to computational thinking.
2. Deconstruct and optimize workshop elements that further develop self-efficacy, agency, and other aspirational outcomes through digital technologies.
3. Develop resources to support training of other trainers. Two immediate targets of such training will be:
  - a. A new cohort of graduate students who will work as part of an Illinois Department of Commerce and Economic Opportunity-funded initiative to deliver digital literacy training using Demystifying Technology workshops and portable Fab Lab kits; and
  - b. Adults associated with the Sunshine Cultural Arts Center in East St. Louis who have expressed interest in learning how to deliver Demystifying Technology workshops on an ongoing basis as part of their new computer lab.



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