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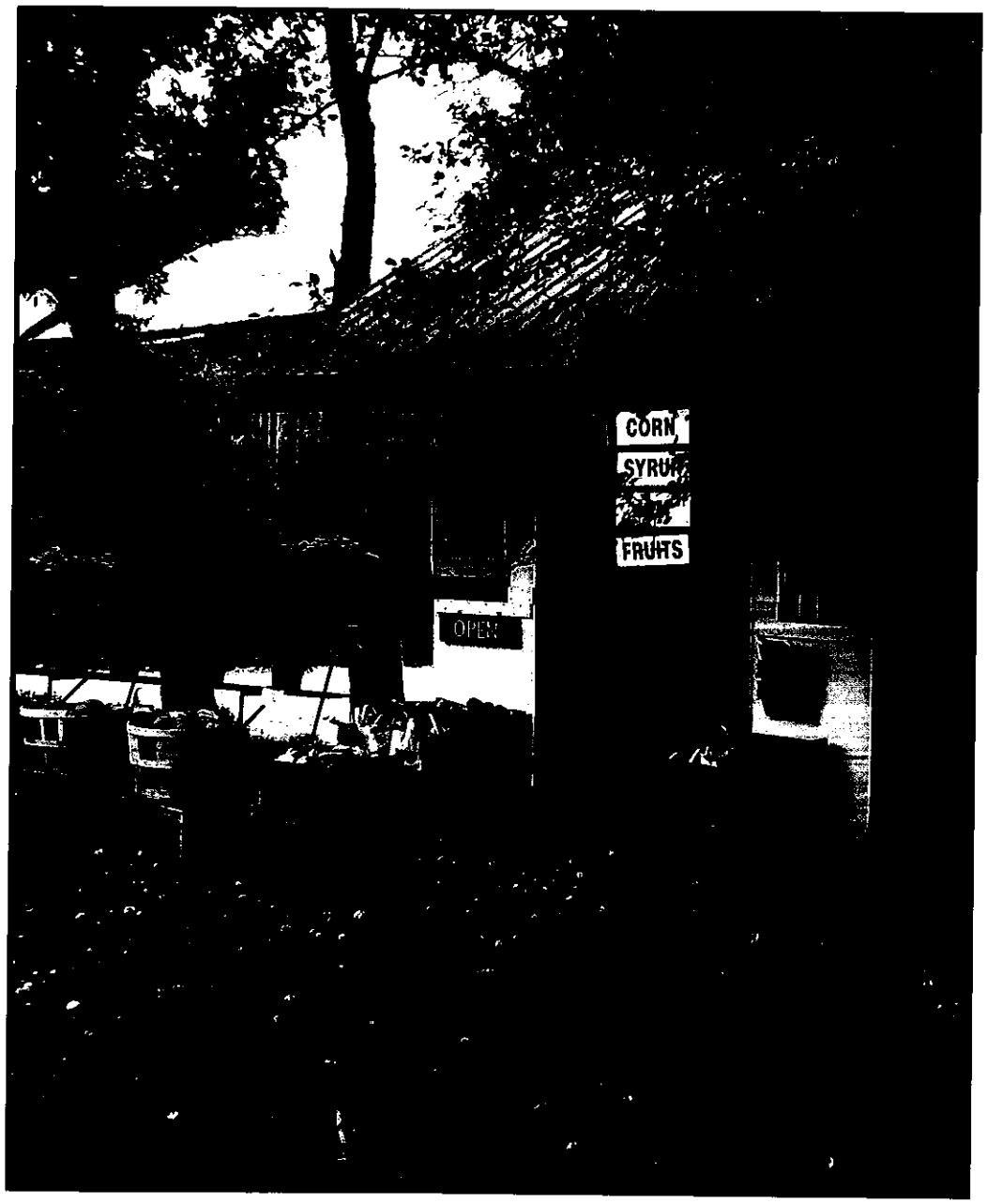

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Positive Technological Development: Working with Computers, Children and the Internet

by Marina U. Bers, Ph.D.

Introduction

Since Turkle's pioneer work published in The Second Self (Turkle, 1984), social scientists have recognized the importance of technology in children's lives. Researchers have observed and analyzed how young people use, appropriate, and assign meaning to the technologies around them. Turkle's early work focused on the first generation of children to play with "smart" toys. Her research aimed at understanding how those electronic toys elicited thinking about self and identity. A more recent trend of research examines the role in children's social development of on-line environments such as teen blogs; social networking websites such as Friendsters, My Space, and Facebook; and multi-player games such as TeenSecondLife (Turkle, 1995, Huffaker, et al, 2005; Boyd, D, 2005). This type of work chooses a descriptive approach to understand what young people **are doing** with technologies. A different line of research focuses on what young people **could be doing** with technology. This interventionist approach has the goal of developing psychoeducational programs and software that have an impact on youth's learning and development. While social scientists describe the contextual ecology of children's use of technology, educators and mental health professionals design effective technologically-rich programs and evaluate their outcomes. Both lines of research are equally important and should inform and nurture each other.

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Over the past ten years, Prof. Bers has designed and used diverse technological tools that range from robotics to distributed collaborative learning environments, and from storytelling programming languages to tangible human-computer interfaces. She conducted studies with each of these tools in elementary and high schools in the US, Argentina, Colombia, and Spain; rural after-school settings in Costa Rica and Thailand; museums in Boston and New York; and young patients and psychiatrists in Boston Children's Hospital. Prof. Bers received her PhD in 2001 at the MIT Media Lab. She can be reached at Marina.Bers@tufts.edu, and her website is http://www.tufts.edu.

My own work focuses on the second kind of research. This paper presents an overview of my framework for designing and evaluating technologically-rich intervention and prevention programs that are aimed at helping children develop in positive ways through the use of technology. I will also describe one such program, which I direct—the Virtual Communities of Learning and Care project that uses the Zora graphical virtual world to connect pediatric post-transplant patients at Boston Children's Hospital.

The legacy of educational technology

Since the early 1960s, the growing field of educational technology has produced varied research programs on the use of technology for promoting math and science education (Kafai and Resnick, 1996). More recently, contemporary researchers—interested in helping children learn about the self—have begun to appropriate computers and design new interventions that will help children develop in positive ways. Within the complex field of study that I am calling educational technologies—composed of math and science educators, cognitive scientists, computer human interaction designers, information specialists, and researchers in the learning sciences—two movements—computer literacy and technological fluency—grew side by side over the years. Both movements address the questions of what it means to be able to successfully use technology in today's world, and how to best approach teaching and learning about technology. While the computer literacy movement heavily relies on developing instrumental skills, the technological fluency movement focuses on enabling individuals to express themselves creatively with technology. This sets the stage for the positive technological development (PTD) framework that I am describing in this

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paper.

The United States Department of Education defines computer literacy as "computer skills and the ability to use computers and other technology to improve learning, productivity, and performance." Today the term computer literacy often connotes little more than the ability to use specific software applications for well-defined simple tasks, such as word processing and e-mail, and knowing the basic principles of how a computer works (Committee on Information Technology Literacy, 1999). In contrast to this computer literacy trend of teaching instrumental skills, the technological fluency movement emphasizes the importance of teaching how to learn and think with technology. The concept of technological **fluency** (in contrast to mere **literacy**) was first introduced by Seymour Papert (Papert, 1980), who described fluency as the ability to use and apply technology as effortlessly and smoothly as people use language. Technological fluency, while including the mastery of technological skills and concepts, also involves the ability to learn to use computers in creative and personally meaningful ways (National Academy Press, 1999). During this process, people are also likely to develop new ways of thinking. For this reason, the computer's role can go far beyond being an instrumental machine.

This line of thinking leads to two important questions. How can we use computers to help children think about the self in different ways? How can we design programs for children to explore their own psychology and their social relations? To answer these questions, we need to understand the ways that computers can affect children's personal, social, and emotional lives. In today's world, children need more skills than computer literacy and technological fluency. Developing competence and confidence regarding computer use is a necessary step. However, it is also important to develop character traits that will help children use technology safely to communicate and connect with other people. In a similar vein, it is crucial to provide opportunities for children to envision a better world through the use of computers. To deal with these issues, I am proposing a Positive Technological Development (PTD) framework. An extension of the computer literacy and technological fluency movements, this framework adds a psychosocial component to the study of the possibilities of technology-rich interventions to promote learning and development.

Positive Technological Development (PTD)

Following Erik Erikson, developmentalists ask the question "what is the job or task of an individual at different times in his or her development?". In this spirit I ask the question, "what is the job of a child growing in a technologically-rich period such as ours?" Computers are in children's lives. Children use them at school, at home, to communicate with friends, to listen to and exchange music, to meet new people, to share stories with relatives, to organize civic protests to shop for clothing, to engage in e-mail therapy, and to find their dates (Subrahmanyam, et al, 2001). In this technologically-rich context, the computer literacy movement might ask how children can use technology to accomplish a task, while the technological fluency movement might wonder how children can use technology to learn creatively by designing and programming their own interactive projects.

Other questions emerge from the PTD perspective. How can children use technology in positive ways to help themselves and the world? How can educators and researchers develop programs that help children use technology to learn new things, to express themselves in creative ways, to communicate effectively, to take care of themselves and each other, and to contribute in positive ways to the self and the world? To answer these questions, PTD draws on two bodies of work: Papert's constructionism, which looks at the role of computers in education, and the positive youth development approach proposed by applied developmental science.

Following Piaget, constructionism might best be defined as a constructivist philosophy for educational technologies. However, while Piaget's theory was developed to explain how knowledge is constructed, in our heads, Papert pays particular attention to the ways that such internal constructions are supported by constructions in the world, through the use of computers (Papert, 1980; Papert, 1993). By creating an external object to reflect upon, people are most likely to construct internal knowledge and develop technological fluency in a playful way (Renick et al, 1996). Thus, constructionism is both a theory of learning and a strategy for education. Constructionism informs PTD by focusing on the design of computational tools for learning and providing guidelines for the development of technologies for exploring issues of self and identity.

In studying positive youth development, applied developmental scientists look at cognitive, personal, social, emotional, and civic characteristics of young people. Researchers speak of six "C"s:

1. Competence: a positive view of one's actions in social skills, academic performance, cognitive functioning, and other areas.
2. Connection: positive bonds with people and institutions.
3. Character: integrity and moral centeredness.
4. Confidence: positive self regard, a sense of self-efficacy.
5. Caring: human values such as empathy and a sense of social justice.
6. Contribution: orientation to contribute to civil society (Lerner et al., 2005).

Taken together, these characteristics reflect a growing consensus about what is involved in healthy and positive development among people in the first two decades of their lives.

The primary goal of these programs and technologies, also called computer-based Identity Construction Environment (ICE) (Bers, 2006), is to help children develop the six C's of PTD: 1) *competence* in the development of computer literacy and technological fluency; 2) *confidence* in their own learning potential and their own ability to solve technical problems; 3)

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caring about others, to be expressed by using technology to engage in collaboration and to help each other when needed; 4) *connection* with peers or adults to use technologies to form virtual communities and social support networks; 5) *character* to become aware of their own personal values, be respectful of other people's values, and assume a responsible use of technology; and 6) *contribution* by conceiving positive ways of using technology to make a better learning environment, community, and society. PTD is both a theoretical framework and a development trajectory, in which opportunities for promoting the six C's are encountered through participation in technologically rich programs that support positive behaviors while using technology. Thus, I am proposing a "six C's by six C's model" in which technologies are designed with specific features that engage children in behaviors that are likely to promote personal assets (see figure 1): 1) *content creation* to promote *competence* in the use of technology; 2) *creativity* to foster *confidence* in children's own uses of technology to make meaningful projects; 3) *communication* in both synchronous and a-synchronous ways to support the formation of networks of *caring;* 4) *collaboration* that enables *connection* between people; 5) *conduct* to engage in ethically and morally responsible actions guided by *character* traits; and 6) *community-building* to design and participate in environments where one can make positive *contributions.*

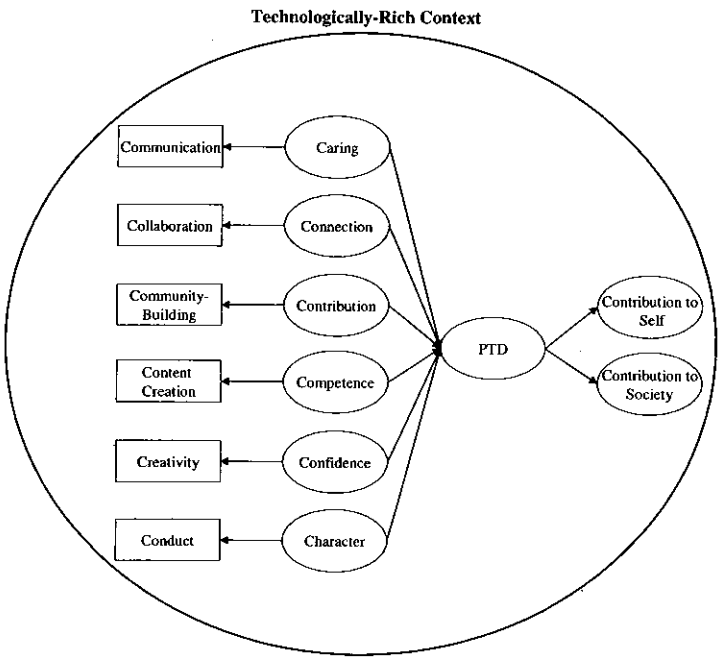

Figure 1: The "C's by six C's model". Technologies' design features engage children in behaviors likely to promote personal assets

As a theoretical framework, PTD is a systematically organized system of assumptions, accepted principles, and rules of procedure devised to analyze, predict, or explain the nature of a specified set of phenomena. While any research project within PTD looks at the "six by six C's" model and aspects of positive technological development, some studies focus on one or more specific C's as learning outcomes. Figure 2, which gives an overview of my research program built on the concept of PTD, refers to some of the empirical pilot studies conducted by members of the Developmental Technologies research group that I direct at Tufts University's Eliot Pearson Department of Child Development. For more information on these projects and related publications, visit: http://ase.tufts.edu/devtech/

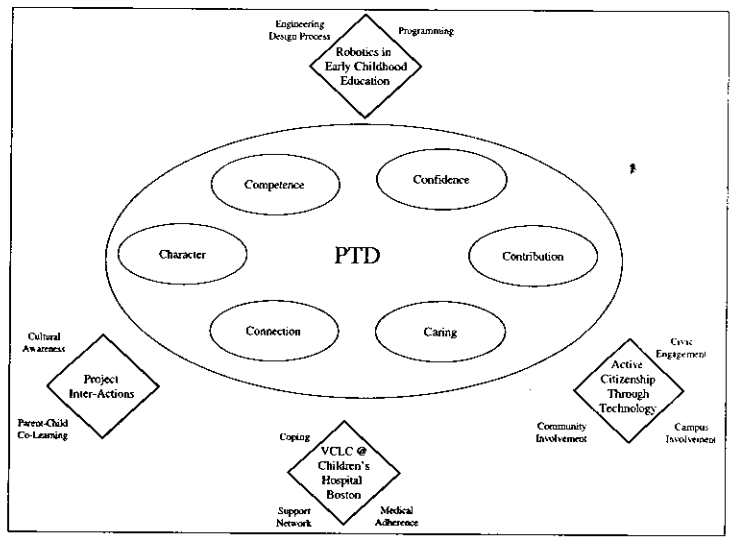

Figure 2: The DevTech empirical research program based on the PTD theoretical framework

Post-transplant patients using the Zora virtual world

One of the on-going PTD projects takes place at Children's Hospital in Boston. Virtual Communities of Learning and Care (VCLC) is a research project funded by the National Science Foundation in collaboration with the Department of Psychiatry and the transplant programs at Children's Hospital. This project provides a unique experience for youth in transplant programs to connect with each other via a graphical virtual world, called Zora. Similar virtual communities, which facilitate new expressions of personal and social life, are playing a growing role in the lives of young people. In the last decade of mental health practice and research, there has been an increased focus on such uses of technology. Examples include on-line support groups, e-mail therapy, informational websites, and the use of virtual communities to share coping narratives (Bers et al, 2002, Rice & Katz, 2001; Bers et al, 2003).

The VCLC project involves pediatric patients in a virtual community where they can design a three-dimensional virtual city, write stories, create characters, chat with each other, and participate in a virtual support group by using the Zora multi-user graphical environment (see figure 3). Using a secure password, post-transplant patients at Children Hospital Boston between the ages of 11 and 15 years old are invited to remotely log in to Zora from their homes. In this way, they connect with other children undergoing similar medical experiences. In

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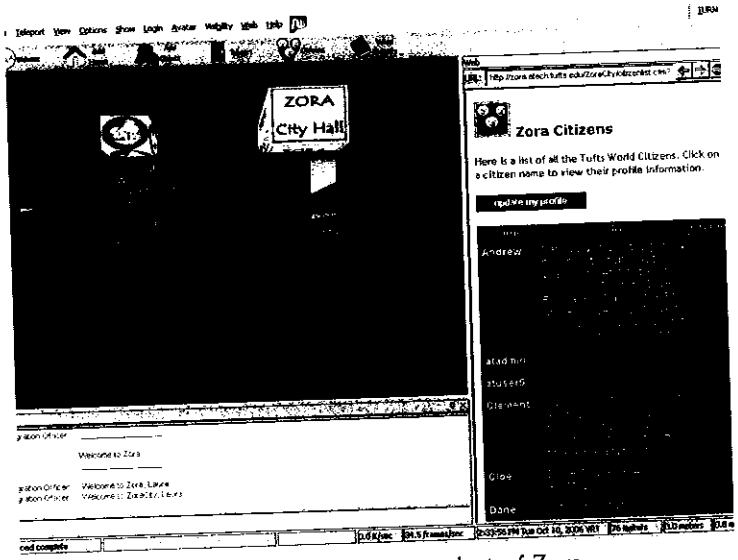

Figure 3 shows a screenshot of Zora

cases of need, a computer and Internet connection is provided for free to children during the duration of the study. Lead by doctoral students in the Child Development Department at Tufts University, weekly activities help children get to know each other, share their concerns, explore coping strategies, and address issues of medical adherence, while at the same time having fun building a graphical virtual city by using Zora. Children's positive technological development, in the context of their particular health condition, is evaluated through pre- and post-questionnaires, semi-structured interviews, home visits, and log analyses of their interactions in the virtual world. In addition, medical charts completed by transplant staff are used to assess Zora's potential impact on medical outcomes such as patients' adherence to treatment protocols.

An example of an ICE, Zora is a technology whose design stems from the positive technological development framework. Zora shares many features with commercially available virtual worlds, such as Second Life, in that Zora fosters communication via avatars and the formation of a graphical virtual community. Zora, however, has unique characteristics due to its purpose of supporting children to explore issues of self and community. Thus, technology becomes a playground for developing different perspectives on self and others, and for experimenting with personal characteristics that might later on transfer to the face-to-face world.

Following the "six by six C's" model, Zora engages children in behaviors in the virtual world with the goal to promote positive assets.

(1.) To promote *competence* in the use of technology, Zora provides user-friendly authoring tools to support *content creation*. Within the metaphor of a virtual city, users can create their own virtual homes and public spaces. For example, post-transplant children in the VCLC project created virtual homes with pictures of their favorite pets, family members, and friends. They also created a Transplant House (a place to share stories about their transplants), a restaurant to explore dietary restrictions while eating everything in the virtual world, and a house for learning the basics of creating a webpage. Other children added content to virtual spaces created by coordinators; examples included a pharmacy, a social room, and a city theater where short movies could be watched online.

(2.) To foster *confidence* in children's potential to learn how to use technology to make personally meaningful projects, all of the activities planned in Zora promote *creativity*. For example, in the virtual press office, children create a Zora newspaper to be mailed monthly to families and other post-transplant hospital patients. Children are in charge of the choice of news stories, the pictures, the reporting, and the editing. In the virtual health museum, they will explore how to make a virtual exhibit about transplants.

(3.) To support *connection* between children, one of the most important aspects of this work (Bers et al, 2003), different mechanisms for *collaboration* were established. Children can contribute objects and stories to any virtual home, and they can work together to build the public spaces. They can help each other and establish different community roles. For example, one of the youngest boys, an avid player of computer games, is taking on the role of tech support in the Zora virtual community. Children can also add their own thoughts to the collaborative values dictionary, which is a compendium of all the personal and moral values (and their multiple definitions) held by the Zora citizens.

(4.) To support the formation of networks of *caring*, Zora provides both synchronous and asynchronous mechanisms for *communication*. Chatting in real time through their graphical avatars, children can discuss the difficulties of remembering how to take so many medications; they leave messages to each other in bulletin boards when they live in different time zones or have different schedules; and they exchange virtual presents as they get to know each other. Children can also communicate with doctors or medical staff, who come to the virtual city as guest.

(5.) Throughout the experience in Zora, *character* traits are explored and developed, as individuals encounter opportunities to *conduct* themselves in diverse situations. The nature of An ICE serves as a safe space, where young people can experiment with issues of character. For example, youth can create personal or moral values and then associate them with their objects. They can make role models and anti-role models; and they can enter values, and define them, in the city's collective values dictionary. In addition, some of the children in the project started to think about which behaviors are appropriate, or inappropriate, for participation in virtual communities.

(6.) To promote *contribution* to the community, all of the activities in Zora are aimed at *community-building*. For example, a virtual city hall invites children to think about the rules

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their virtual city should follow and the different issues involved in the daily management of the city. A system of compensations is given to all Zora citizens when an individual makes a contribution to community life. For example, if a child cleans up the virtual objects left in the shared green areas, that child is able to choose a new three-dimensional object to be included in the database of objects available for community use.

The VCLC project is in its initial phase. However, the first observations seem to be aligned with results from previous studies done with young patients and medical staff in the Dialysis Unit at Boston Children's Hospital (Bers et al, 2003) and with a multi-cultural group of pre-teens and teens in the context of a summer camp (Bers, 2001). Children are starting to show signs of moving in a direction of positive technological development. Twelve-year-old Billy, for example, is a shy and loner boy still adjusting to the aftermath of transplant surgery. His medicines alone make his life atypical. At first, Billy was reluctant to participate in Zora; but now, Billy is a central figure in the group. He does not talk much, but he is expressing himself by constantly building in the virtual space. In a purely constructionist fashion, Billy is slowly learning to open up and share with others not through chatting on line, but through making virtual objects, helping children with less technical skills and creating new virtual spaces (such as a pet store and a library) for the enjoyment of the community. Kate and Gloria are two fifteen-year-old teenagers, who, despite living miles apart, are for the first time getting to know someone their age who went through a transplant. Instead of building in Zora, these adolescents want to chat and share experiences; and they are using the virtual world to find a way to meet face-to-face.

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