Technology, Culture, and Adaptive Minds: An Introduction

Xiaodong Lin & Giyoo Hatano

ARTICLES

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Xiaodong Lin
Teachers College
Columbia University

Giyoo Hatano
Human Development and Education Program
The University of the Air

This special issue, inspired by the spirit of Jan Hawkins, focuses on ways that our knowledge of technology, culture, and adaptive minds can be brought together to create new opportunities for learning and personal growth. Jan cared deeply about these issues and explored them in her own work and in her travels throughout the world. She was one of the first to call our attention to the social and equity issues around the design and uses of technologies (Spiro & Collins, 1999). Her research style included helping people from different disciplines connect with one another personally and electronically to solve common problems. The special issue will follow her lead by exploring in detail issues such as what roles technology plays in human learning and cultural change, how diverse cultural contexts interact with a new technology to produce varied outcomes, and ways in which human minds adapt themselves to technology as well as adapt technology to them.

The four articles in this special issue represent new research efforts that explore how cultures can influence and learn from one another through the technological artifacts they exchange and sometimes co-develop. The technological artifacts involved in these studies range from physical houses and procedures for building them to computer software and 3–D virtual worlds. We view these artifacts as closely associated with particular cultural practices, not as material and symbolic entities separate from their cultural contexts. As such, exchanging and co-constructing technological artifacts often implies exchanging and co-constructing a particular set of cultural values and practices (Lin, 2001). When these values contrast with another, such exchange may make invisi-

ble cultural needs and beliefs explicit, and may also precipitate (often unplanned) changes in responsibilities, roles, and practices.

The special issue explores the role of technology as a catalyst for changes in classroom culture and as a mediator for new forms of human interactions and learning. Two of the articles look at technology in cross-cultural settings, and the other two articles consider technology in the context of a sub-culture within a larger culture. Jointly, they present a picture of how people adapt technology to meet their diverse needs, while they adapt their educational practices to respond to the technologies.

TECHNOLOGICAL ARTIFACTS AS A CATALYST FOR CHANGE

Throughout history, technologies have served as powerful catalysts for change, whether introduced from within a culture (e.g., the printing press; Eisenstein, 1979) or from another culture (e.g., the snow machine; Pelto & Muller-Wille, 1987). They can produce unpredictable changes, which include both challenges and opportunities for human learning and development. This is in part due to their secondary effects, a few examples of which are given in the following. At the individual level, a new tool often requires learners to master a new set of skills, whereas making the skills for using its predecessor obsolete (Wertsch, 1995). As a result, people develop new knowledge about their own abilities to think and solve problems. At the interpersonal level, a new tool may change the power relationships among people, such as relations between teachers and students, explored in the studies by Schofield and Davidson ("The Impact of Internet Use on Relationships between Teachers and Students"), and by Lin and Schwartz ("Reflection At the Crossroads of Cultures"). These power shifts in classrooms may be related to the fact that modern technology often deprives experts of their privileged status by redefining the expertise needed to accomplish academic or occupational tasks. A new tool may also create new folk models and ideals. For example, such notions as the "barrier-free environment" and "equal opportunity employer" that apply at the community level are greatly enhanced, if not induced, by the invention of the wheel chair.

A new tool tends to influence people's life beyond its enhanced efficiency in achieving specific goals, in part due to its unanticipated extended uses. Even though the design of a new tool is originally embedded in a particular practice, it is often used in other contexts, sometimes in ways, which its designers never imagined—for example, the Amazon.com web-site can be used to find book citations.

Another notion shared by all four articles is that technology is rarely "culture free" in the sense that it brings about homogenous changes in all cultural contexts. How a new tool influences peoples' lives, positively or negatively, depends on how it is introduced and incorporated. A modern mass-production technology may sweep away local, indigenous technologies, or both types of technologies may coexist, each serving different users and varied needs. We would like to emphasize that what a new tool brings about depends on the interaction between the tool's intrinsic properties and the prior culture of the people who use it, or more specifically, the already existing set of tools, beliefs, and practices. Adaptive minds can often find a good match between a tool and the local cultural context through improvisation and reflection. The work by Lee ("Toward a Framework for the Design of Culturally Responsive Digital Environments") strongly suggests that to be successful a new technology should be "responsive" to the needs, strengths, and values of the learners when introduced into classrooms. Technology design should leave space for different

cultures to build on their strengths and to adapt the technology to their culture. This space will allow, for example, individual teachers and students explicitly to choose aspects of an artifact for use and reflect upon their choices.

These considerations imply that only flexible artifacts are likely to be effectively applied to many different cultural contexts (Lin & Hatano, 2002; Schwartz, Lin, Brophy & Bransford, 1999), because the needed adaptations cannot be predicted ahead of time and must be improvised on the spot. This is particularly true in classroom settings, owing to the dynamic interactions that characterize them. On-the-spot adaptation requires users and designers to be open-minded about uncertainties and to seize emerging learning opportunities. Therefore, the changes observed when technologies are successfully introduced into classrooms are the result of adaptation made through ingenious improvisation and careful reflection as well as decision making by the local teachers and students. Although every technology is likely to be accompanied by both positive and negative outcomes (e.g., cars bring pollution as well as rapid access to distant places), these outcomes will be modulated by the existing classroom culture.

Understanding the interaction of the tool and the sociocultural context will provide clues for the humanistic uses of new technologies. The articles collected in this special issue reveal this improvising and reflective adaptation process (Hatano & Inagaki, 1986), where teachers and students adapt technology to meet their diverse classroom needs, while adapting their educational practices to take advantage of the affordances offered by the technology—a bi-directional adaptation process.

TECHNOLOGIES AS MEDIATORS FOR NEW FORM OF HUMAN INTERACTIONS

Technological artifacts "re-mediate" interactions among people and their environment, so that people can do things that would be more difficult to do without them (Cole, 1996). For example, global telecommunications technology permits cross-cultural exchanges that would be far more slow and quite difficult otherwise (many children and teachers do not live under conditions that make such contacts likely to happen). Internet technologies *potentially* allow contact with a wider variety of other cultures and expertise than face-to-face meetings, affording new opportunities for reflection. Two of the current papers pay close attention to the kinds of learning and reflection that occur when people interact with people from cultures other than their own (see Hammond "Building Houses, Building Lives"; Lin and Schwartz, "Reflection at the Crossroads of Cultures"). In the first case the interaction is mediated through face-to-face interactions in co-constructing school–community gardens and houses; in the second case the interaction is mediated through the use of the Internet and 3-D virtual technologies.

These studies reveal that exposure to different cultural values and practices may make invisible cultural needs and beliefs more visible, so that deeper learning and revision of core values will occur. For example, the cultural interaction involved in Hammond's study created rich opportunities where teachers, children and parents from different cultural backgrounds had to communicate and negotiate over their different principles and practices. Such interaction was so dynamic that many unplanned conflicts in cultural values and practices arose throughout the process of the collaboration. These conflicts forced all parties to learn to resolve their differences and to create space for

all to contribute, as they worked together toward common educational goals. Most valuable were the situations in which people discussed the choices they made, and why they made them.

Facilitating cultural interaction with the help of technologies is a very delicate business. Simply putting people of different cultures in contact does not guarantee that their learning experiences will be positive and helpful. Misunderstandings often result from cultural differences, and if left unattended, may negatively impact teachers' and students' attitudes toward people from other cultures (see Lin & Schwartz, this issue). These attitudes can hinder people from learning about other people and themselves. Lin and Schwartz explored how various forms of cultural interactions affect learning and reflection. Their work suggests that cultural interactions involved in creating joint artifacts and knowing each other as individuals creates a bond between members of different cultures and allows people from different cultures to discover their own strengths and weaknesses that would have remained invisible without such interaction.

The studies in this collection provide only an initial understanding of the learning potential offered by various types of technology-mediated cultural exchange. Questions remain about how to study new technologies, especially when many of the cultural and educational outcomes are not predicable by the designers and educators.

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Each article in this issue attempts to explore these challenges in detail. In the first article, Lorie Hammond ("Building Houses, Building Lives") presents a field study in which mainstream American teachers, assisted by a Laotian student teacher, worked with American and Laotian parents to build a garden and field house as part of an urban school–community science curriculum project. The initial goal of the project was cultural heritage preservation for Southeast Asian elementary school children and their families. However, the process of working together through the building of a concrete technology, a field house and a school garden, enabled both parties to develop trustful relationships and to construct a new joint culture, neither Laotian nor American, but influenced by both. It is through experiencing the ways in which each group approached the technology of building a house and planting a garden that each could see the other and could adapt to new practices. Too often, multicultural projects deal with idealized versions of cultures, as told through stories and accounts. Concrete technologies, which are shared between cultures—such as house building—can often communicate different cultural values and practices in an explicit manner.

The second article by Carol Lee ("Toward a Framework for the Design of Culturally Responsive Digital Environments") looks at changes in literacy practices induced by the use of computer-based software tools designed to support students to develop literacy reasoning in response to canonical literature appropriate to African–American elementary and high school students. The paper uses cultural-historical activity theory as a lens for analyzing how students' reflective adaptation of each tool resulted in changes in students' learning. She examined not only the role of the mediating technological artifacts, but also the norms for social interaction, the intellectual quality of the literacy tasks, and the particular practices designed to support learning. Her findings indicate that as students interacted with the tools in two educational contexts, they employed language and communication patterns that are specific to African–American culture. She concludes the article by suggesting ways that educational technology might be designed to be "culturally responsive" and to leave room for all cultures to build on their strengths.

"The Impact of Internet Use on Relationships Between Teachers and Students"), also investigated the effects of computer-based technologies, but with the focus on changes in classroom roles and relationships they bring about. Schofield and Davidson carried out 5-year study of a major effort to bring the Internet to a large urban school district. They found that Internet use increased student autonomy, both in the classrooms of teachers (who had not planned this outcome) and in the classes of teachers who intentionally used the Internet to foster this change. Further, Internet use frequently resulted unexpectedly in warmer and less adversarial teacher–student relations, teachers' discovery of unexpected Internet skills on the part of students who had not otherwise impressed them, and teachers' new appreciation of the difficulty of learning as they themselves coped with the sometimes forgotten experience of mastering something new. Finally, a variety of new and generally unanticipated student roles emerged in high schools using the Internet, in which students served both as tutors for their teachers and as technical experts for their schools.

The final article by Xiaodong Lin and Dan Schwartz ("Reflection at the Crossroads of Cultures") describes the kinds of learning and reflection that occur as a result of different forms of interaction with technological artifacts and with individuals from cultures that differ from their own. They explored how interaction and learning can be accomplished both in person and virtually. Their work shows that when people engage a new culture, whether across oceans or classrooms, they experience an increase in reflection about their own identities, goals, and responsibilities. Because of its appearance in new cross-cultural contacts, reflection appears as a deeply social act. In addition, they identify two significant social functions of reflection. First, it helps people decide which cultural practices to appropriate and how to adapt them. Second, it helps people become more receptive to the presence of different values and practices. Their article presents several research instances in which technological artifacts are used to promote cross-cultural contact. In some cases, the artifact communicates culture because of the practices it suggests. In other cases, the technology helps people communicate directly about their values and practices. Based on their successes and failures, they offer a set of provisional design principles for technologies that encourage reflective learning through cross-cultural reflection.

The special issue concludes with the commentaries by Bransford and Cole, who consider some features that all the articles have in common and will share their thoughts about what the next steps should be to create a broader dialogue about how human learning can be enhanced by technology, cultural diversity, and improvising and reflective adaptation. In addition, several of Jan Hawkin's close colleagues, Margaret Honey and Allan Collins offer valuable insights as to how Jan would think about the kinds of work discussed in the special issue.

ACKNOWLEDGMENTS

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