Educational technology is a far richer concept than simply the use of computers in school. By taking a fuller view of children’s learning and technology, we can imagine an exciting future for educational design.

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Educational technology, reimagined

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As a prelude to this article—and in keeping with my own academic background—here is a brief homework assignment that you can try at home: using your favorite Web search engine, look for images associated with the term “educational technology.”

Why an image search as opposed to a textual search? Because for these purposes, the former is especially revealing: It produces, in tableau form, the pictorial associations that our culture has adopted for a particular concept. In the case of “educational technology,” those associations are clear. The preponderance of the images will be photographs of children sitting at desks, in classrooms or computer laboratories, in front of computer screens.

There is nothing particularly objectionable about these images. The children in the photographs are usually smiling, and perhaps the smiles are genuine. And children do make use of computers—sometimes highly productive use—in classrooms around the globe. Nonetheless, the images indicate a depressingly narrow and constrained view of technology, and indeed of children themselves. In broad terms, the images equate “technology” with “computers.”
(or, even more narrowly, with “desktop computers”), and they equate “education” with “the classroom.” Neither of these equations is remotely adequate for either studying or designing the next generation of educational technology.

Over the past decade or so, at the Craft Technology Lab at the University of Colorado, my colleagues and I have worked to expand the range of images associated with educational technology. In particular, we have undertaken numerous projects intended to blend technology into children’s activities and hands-on crafts. Some of our projects have focused on paper crafts—software applications for the creation of individualized, expressive paper sculpture, novel polyhedral models, or appealing pop-up cards. Other projects have investigated ways in which children can create working mechanical toys, programmable clothing, and string figures. (An overview of our work can be found at the lab’s Web site: www.cs.colorado.edu/~ctg.) For the purposes of this discussion, the following three themes recur in our work:

• An emphasis on creating rich, imaginative, challenging, and aesthetically appealing activities for children rather than programs intended to “teach skills”
• An emphasis on blending technology with hands-on materials and tangible experience, as opposed to purely screen-based technology
• An interest in the elements of day-to-day children’s culture that take place outside the classroom and often elude the attention of school systems and adults more generally

With these interests in mind, we can now return to the focus of this article: reexamining the reigning cultural notions of educational technology. We begin with the second of those two words. The insufficiency of “desktop computers” as a synonym for “technology” is by now strikingly apparent. The plethora of forms for mobile computing—laptops, netbooks, programmable phones, portable book readers, and the like—represent a significant
extension of computing into children’s day-to-day environments. Children and adolescents have computers of some sort on their person at the playground, at parties, on field trips, on vacation, at the breakfast table, and indeed just about everywhere else. Yet incorporating “mobile computing” into the definition of “technology” is hardly sufficient. Increasingly, children have access to a remarkable range of output and fabrication devices: color printers, programmable paper cutters, computer-controlled sewing machines, laser cutters, and three-dimensional printers. Collectively these permit youngsters to design and construct an astonishing range of physical objects. Novel materials, such as conductive paints, glues, and threads, enable computational elements to be combined with, or embedded within, various materials such as textiles, paper, and ceramics. Tiny portable microprojectors enable all sorts of surfaces to be used as improvised screens. Even this brief discussion could be extended by examples ranging from the mundane (memory sticks, GPS-equipped devices, pen-based computing, Webcams, RFID tags) to the slightly more futuristic or experimental (programmable paper, three-dimensional or volumetric displays, increasingly responsive robotic devices).

Reconsidering the meaning of the “technology” half of “educational technology” suggests, in its turn, a reconsideration of the “educational” side of the standard images as well. Because the technological range of children’s environments has extended beyond the desktop, the opportunities for educational design are themselves far more interesting than stand-alone applications or Web sites for use in the classroom. The imaginations of both children and educational designers should be freed in tandem. As designers of educational technology, we can envision (among many other possibilities) projects like the following:

- Playgrounds whose equipment can respond in dynamic ways to programs sent from portable phones
- Children’s paper crafts that incorporate “paste-on” computers and sensors to produce, for instance, programmable pop-ups, stories, and paper sculptures
• Board games and construction kits in which children can design and print out customized parts or playing pieces
• Science projects, such as meteorological stations, that make use of GPS capabilities to behave differently as they change location
• Programmable clothing for occasions such as sporting events, Halloween costume parties, theatrical shows, and many others
• Games that make use of microprojectors so that children can create animations on their own personal devices and then superimpose those animations in clever ways by projecting them simultaneously on a shared surface

The purpose of these examples is merely to hint at the ways in which creative learning opportunities for children may be diffused through their day-to-day environments in ways that would tend not to be visible to a classroom-centric view. But this does not at all imply that the world should “become a classroom” in any meaningful sense of that phrase. Instead, the larger point here is that designing worthwhile activities for children—that is, activities that afford children the opportunity to create, build, reflect, exercise curiosity, and cultivate lifelong interests—is a task that requires attention to the larger scope of children’s lives, way beyond the few settings (such as classrooms) that tend to be on adults’ radar.

This last point—that we need to pay attention to children’s fuller lives—is really the crucial one. It leads us to explore the literature not of classroom practice or instruction (which accounts for the vast majority of learning sciences research), but rather of children’s anthropology. It leads us to books such as Peter and Iona Opie’s *The Lore and Language of Schoolchildren*, James S. Coleman’s *The Adolescent Society*, Mihaly Csikszentmihalyi’s *Talented Teenagers*, and Murray Milner’s *Freaks, Geeks, and Cool Kids*, to name a few—books in which the lives of young people are closely and sympathetically observed without being romanticized.¹ Not all of these books are recent, but even the older ones are essential reading for charting the future of technological design for children. The authors of these
books address such questions as, “How do young people spend their time?” “Which of their peers do young people admire, and why?” “How are friendships among children and adolescents formed and maintained?” and “How do children and adolescents develop (or fail to develop) intellectual or academic interests?”

For designers of educational technology, questions such as these represent the beginning of insight into what sorts of artifacts we should be imagining, prototyping, and testing. Looking at both the abiding and evolving characteristics of children’s cultures leads us to think about ways in which technological design can be woven effectively and productively into the intellectual lives of young people. In effect, we can now try to create learning technologies that fit tastefully into children’s environments and occupy meaningful ecological niches in their worlds.

To illustrate this point, what follows are a half-dozen anthropological themes that could well suggest novel and worthwhile projects in educational technology. These themes are all prominent in the literature described earlier, but they tend to be ignored, or underrepresented, in the mainstream accounts of educational technology. Although this is not the occasion for a thorough exploration of each of these themes (that would require a much longer discussion), the intent is to at least suggest fertile ways in which designers can experiment with the possibilities of an expanded technological landscape:

• **Hangouts.** Young people (especially adolescents) congregate in favored places outside school: in malls, parks, playgrounds, and other settings. The meanings of such places—how they are chosen; how those choices are influenced by factors such as geography, gender, and class; how they influence young people’s activities for good and ill—are all issues that have largely been absent from the classroom-centric view of educational design. Rather than inserting technology into the settings where young people have to be, it might be profitable to imagine technological artifacts—public games, projects, contests—designed with an eye toward improving or enriching the places
that young people actually go to of their own accord. For example, one might imagine designing large wall-sized dynamic displays in malls or shopping centers; such displays could be affected or controlled by programs sent from cell phones. In this way, one might try to move the local hangout in a direction that at least mildly encourages intellectual challenge.

• **Economies.** Within children’s cultures, the presence of various sorts of “economies”—of trading cards, toy cars, marbles, and myriad other collectibles—represents a surprisingly powerful and abiding element. Such economies constitute, at their best, introductions to concepts of trading, bartering, cooperation, and auctioning, among others. Within the world of multiplayer online games, these toy economies have become prominent features, but there are still many opportunities in this realm for educational designers to employ new technologies. One might imagine (for example) individually programmable cards that combine into larger dynamic murals, or tools through which children can design and print out (using three-dimensional printers, for example) their own customized “collectibles.”

• **Rooms.** Rather than assuming that educational technology is exclusively associated with classrooms, we might rather, as designers, reimagine ways in which technology can enrich the personal rooms and spaces of children. These, after all, are the spaces in which children post artwork, arrange souvenirs, display their collections, gaze at mobiles and wallpaper patterns, daydream while looking out the window, and generally develop their own individual patterns of reflection. Moreover, as Steven Mintz pointed out in his book *Huck’s Raft*, American children are increasingly spending time alone in their rooms (among other reasons for this trend, more children have a room of their own, and many parents are more reluctant than previous generations to send young children outside to play without supervision). Educational technologists might, for instance, design simulations that could run, over the span of weeks and months, on a child’s nighttime ceiling; or children might design,
with the aid of computers, objects that are specific to the
geometry or location of a room, such as objects that cast specific
shadows when the sun rises outside the child’s window.

- **Rituals.** Children’s lives are punctuated and structured over
  periods of weeks and years by recurring rituals: holidays,
  birthdays, special events (for example, the loss of “baby teeth”),
  and many others. Such events should suggest interesting
  opportunities for innovative learning activities. The notion of
  “programmable Halloween costumes” was mentioned earlier;
  one might also imagine tools for the design of dynamic or
  customized party decorations, party games that make use of cell
  phones and GPS systems, and innumerable other possibilities
  for weaving challenges into ritualistic occasions.

- **Displays.** For many children and adolescents, a significant
  opportunity for expressing creativity is through the medium of
  public artistic display. In suburban households, such displays
  sometimes take the form of front-yard decorations for
  Christmas or Halloween, for example. In adolescent cultures,
  the element of display is personalized, linked to a search for
  identity, and expressed in choices of clothes, accessories,
  hairstyles, and the like. Within the academic domain of the
  learning sciences, such adolescent displays are rarely discussed;
  indeed, it might not be unfair to say that they are almost a taboo
  subject, assumed to have no connection to intellectual
  development. For educational technologists, however, there
  should be a strong interest in blending the culture of personal
  display with intellectual challenge, particularly since personal
  technology (including wearable computing) is increasingly a key
  element in the formation of adolescent subcultures. Educational
  designers might design tools for the creation of programmable
  jewelry, hats, shoes, and sports outfits, for example; or they
  might integrate expressive computation into the creation of
  personalized musical instruments, car ornaments, or front-yard
  displays.

- **Buddies.** Finally, and perhaps most important, the literature on
  children’s anthropology makes clear that peer cultures are
particularly meaningful for young people—not only in their social development but also in their intellectual development. Some children are fortunate to have peers who encourage intellectual achievement; others are perhaps fortunate in avoiding peers who denigrate that sort of achievement. Still others are not so fortunate and grow up within peer cultures that stifle each other’s intellectual ambitions and pursuits. Again, this is an area that educational technologists need to study carefully to motivate future design. We might ask how peer groups make intellectual use of the landscape of social networking tools and communications technologies that permeate their lives. By exploring these issues, we could seek to create tools and systems that encourage shared construction activities, research projects, or artistic endeavors.

Each of these themes—hangouts, economies, rooms, rituals, displays, and buddies—thus represents an opportunity to rethink educational technology beyond the constrained images of classroom computing. The advent of new technologies for communication, material construction, fabrication, and human-computer interaction allows us an unprecedented scope for reimagining children’s lives for the better. At the same time, these new technologies, and their increasing place in children’s day-to-day lives, make the traditional portrait of desktop classroom technology seem increasingly limited and arbitrary by comparison. By rethinking educational technology outside the classroom, we may eventually come full circle and bring our designs back into the schools. In this way, an expanded view of children’s lives and cultures might enable designers to create far more innovative and effective classroom environments as well.

Notes


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