

Digital Kids and Media: An Overview and 4 Digital Questions¹

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Young kids are terrific. They are curious. They are playful. They are interested in the world around them. They are communicative.

Then we put these kids into schools, with the purpose of passing on what we know about the world, and providing a place outside of the workplace where they can learn safely. And all of a sudden the kids are not so curious, they are not so playful, interested or communicative.

With the advent of widespread digital technologies, we are starting to see interesting and interested kids again, as they engage these new technologies intensely and imaginatively. Those who have broad access to these tools integrate them actively into their social environments, their fantasy worlds, their economic contexts, their entertainment, their family lives, and even their school activities.

Across the USA teens connect to the world in the evening in the privacy of their bedrooms, contributing to blogs, connecting with IM, downloading playlists of hip music, checking out the latest fashions, and generally surfing the net. Teens across the world are carrying mobile devices that help them create their own personal places and a connectivity that keep them linked with their intimate friends, and to the broader world of sports scores, concert venues, movie showing times, etc.

These kids select from the range of technology options as an artist might from a palette, mixing and matching to accomplish their own goals; they don't focus on the technologies, but instead on the activities they want to engage and the goals that they might have set for themselves. They don't necessarily use the technologies in the ways they were intended, but instead tinker with them to accomplish things that please them. And they don't care much about the technologies in a technical or analytic sense, instead becoming immersed in the social environments that these technologies engender.

Looking at this phenomena in one way, these kids are foreshadowing the larger cultural contexts that will emerge as adults become more playful and comfortable with emerging digital technologies. Looking at it in another, the new digital technologies match fantastically with budding adolescents, providing wide flung opportunities for freedom, self definition, immersion in pop culture, defiance of norms, and isolation from the adult world. From as yet another perspective, this universal excitement of youth with digital technologies represents new opportunities for the culture to encourage traditionally

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valued activities (learning science, becoming a contributing community member, self expression, understanding one's environment, becoming empathetic, etc) in this far flung digital domain in addition to playful activities

Which ever of these perspectives one chooses, it is clear that something very important is happening to teens in our culture as digital media become prominent in their lives.

It is clear that there are changes in the nature of play for current teens, who can now act out their fantasies on screens as well as on sports fields and in diaries. Also the entire notion of play is extending, from something one does in a safe environment in preparation for other more serious endeavors to something that can have immediate real world consequences (from buying something, to making money, to developing new friends, to),

It is also clear that there are very different patterns of use of digital technologies between different groups of kids. Race, sex and class seem to be predictors of differential patterns of digital engagement. Access and technical capability vary across youth, as do their choices from the wide ranging possibilities that are available (most often for free, which makes their choices even more interesting, and outside of many commercial analyses).

And changing technologies, an expected event in the fast moving digital arena, are frequently changing patterns of digital media use. Fads and new pricing structures (for cell phones with pictures for example) change youth activity often, hardly leaving a path for late adopters to catch up with the early innovators.

Movement from old fashioned "personal computers" to mobile devices (be they portable computers or cell phones) that enable "intimate computing" that is available anytime/any place changes the range of options for kids in intertwining their everyday face to face lives and their highly distributed virtual existences. Computation yields to communication yields to collaboration as the themes of the digital arena, and the youth gets more and more engaged with each shift.

Much of kid's use of digital technologies is spontaneous, as they find a tool and use it in their own ways. Instant messaging, a free application that costs nothing to use, has been cultivated into a powerful communications device in its creative use by teens; new abbreviations have developed, a new kind of syntax has emerged, and a new set of practices have emerged as classrooms, family rooms and meetings are full of kids who look like they are present whereas they are actually paying most of their attention to their online buddies.

Most of kid's use of technologies are in isolation; they may be connected to many other friends or resources, but they are typically on their own with their digital devices. Their use is also usually quite independent of place; the physical surroundings of the kids makes little difference to their activities as long as they can concentrate on what they are doing. And it is independent of time; many interactions are asynchronous so that there is no need to pay attention to the time of day when communicating with someone (an

excellent feature for crossing international time zones). Moreover, the activities are most often transient; they are not aimed toward the creation of some well composed final product but instead they are steps in the sand that will be soon replaced with other spontaneous activity.

Transcending local social contacts, physical place, time and permanence is quite a compelling set of possibilities offered by digital technologies. It is certainly a powerful list to attract teens, especially when one adds that most all activities are completely unsupervised by adults!

These spontaneous activities of kids provides us continuing insights on the nature of humans, how they play, how they connect with each other, what is important to them. They are especially interesting when the activities are new --- for example dense communications with friends who live far away, or connections with activities and resources that are not available in local neighborhoods. For the study of psychology and sociology and anthropology is based on a given human environment; as we change these environments we can gain insights on how humans adapt to these changes and how they incorporate new capabilities into their “humanness”, and how the notion of humanness might change with these opportunities.

Many of the activities we see in digital kids are highly consistent with current ideas of adolescence as a developmental stage for youth. The connective glue between friends may change, for example, but the social structures may be quite the same, with the same indicators of prestige and belonging that exist in non-digital formats. The nature of the game and the quality of the graphics may be new, but the notion of play and participation and competition may stay the same.

Interestingly, early in the introduction of digital technologies, it was suggested that computers would be key to the “augmentation of the human intellect”, and moreover, that the creation of new “thinking technologies” would create opportunities for new styles of thought and new kinds of collaborative communities enabled by the emerging information infrastructures (Engelbart 1962, <http://www.bootstrap.org/>). Given this framework, we would also expect that emerging digital technologies will change the nature of human thought and human organizations and human customs. We might also expect that the stages of intellectual and social development may change drastically in these new technological environments.

I address this general issue and some possible approaches to it in *Digital Question Fragment #1: Digital Technologies as Thinking Tools: How might we enable complex thinking in a changing world?* that follows this overview section (p.8). I argue for importance of considering a dynamic between human and tool systems, and an approach that expects change, documents it, and encourages it in some instances.

And so the activities of digital kids are extremely important to monitor and understand. They may well presage large general changes in the society. They also are important to acknowledge as we design social and learning environments for youth, for example schools. If kids are fundamentally different, then to be effective, schools and other institutions will invite change as well. They cannot forever, as is currently the case, exist in a parallel universe that doesn't acknowledge the range of technical tools and digital savvy kids that are central to the worlds in which they operate.

Yet, as many will acknowledge, changing schools is not a simple endeavor. More specifically, introducing digital technologies into schools has been remarkably unsuccessful. Although there have been highly innovative examples of digital learning environments introduced in the last three decades --- including programming environments, learning games, interactive multimedia products, simulations, and the internet --- these have had remarkably little sustained impact during this time, and the innovation in these areas seems to have slowed in recent decades with changes in business models and technical standards.

I provide an analysis of this issue in *Digital Question Fragment #2: Where in the World is Carmen San Diego: Where is there a place for transformational learning software?* (p. 16). I summarize some of the activities I directed at the Apple Multimedia Lab (1987-1992) where there was great technical and design accomplishment quite independent of mainstream adoption by schools.

Notably, however, there has been substantial adoption of basic digital tools into schools for self expression. Word processors are widely used, and more importantly styles of teaching writing have evolved to take advantage of this tool. (Though these tools were developed initially for secretaries, their somewhat unexpected impact on how we all write and edit has basically eliminated these positions!) And many schools have embraced these opportunities in providing their students with solid writing skills. Projects like the Bay Area Writing Project (<http://www.bayareawritingproject.org/>) have developed, for example, which rely heavily on peer review and editing cycles, powerful elements of writing that are facilitated greatly by word processors.

Interestingly, this incorporation of word processors into schools is an example of how learning changes with new tools. It is also a good example of how serious consideration of the opportunities afforded by a digital tool is integrated into curricular activities. The word processors enable good writing; a writing curriculum is required if one is to take advantage of this opportunity however. Spontaneous activity with the tool has little impact on the quality of the writing, except perhaps to make papers more attractive and easier to read by teachers (not an insignificant thing, but not at the level of enhancing basic self expression).

Recently, more and more visual displays are being introduced into schools to encourage self expression. Kids love including pictures in their reports, and they especially love making movies. Yet in contrast to the writing scenario, there are few substantial examples of curricula being developed to take advantage of these highly visual tools. Schools are quite comfortable with the printed word; they are not similarly congenial to images, especially dynamic images. For all their good intentions, most school teachers have little experience themselves in the fluid use of imagery, sound and movies in presenting ideas. And so most activities in these areas are not very substantial for students. Many youth produce effective work spontaneously, and this is interesting. However without a curriculum one can not expect this digital imagery fluency to quickly become a substantial or widespread activity.

I introduce this issue briefly in *Digital Question Frame #3: 1000 Monkeys at Typewriters: How might we encourage digital design fluency?* (p.30). I point out a number of potential confusions in this promising area, and suggest some activities to pursue its development (including building on *VizAbility (Course Technology 2004)*, a multimedia product which I co-authored).

But should we care about curricula? As we think about schools and how digital technologies might be incorporated for learning or self expression, we should note how far away we have moved from the basic “spontaneous digital activities of youth in their out of school time” that was discussed at the beginning of this article.

For we have introduced some intentionality, and some judgments of what is “good” or “desirable”, all of which can be highly controversial. We have introduced the notion of “design”, where activities or devices or curricula may be deliberately created to accomplish particular purposes. We have moved from being observers to being creators. More radically, we have introduced adults and adult judgments into the considerations of digital activities and youth. And we have inadvertently begun to think of physical places where there are many adults and youth interacting (eg schools), moving well beyond the “anywhere/anytime” accessibility of virtual worlds to kids who are on their own with their digital devices (computers, cell phones, PDAs).

I acknowledge this shift briefly in *Digital Question Frame #4: Distributed Learning Ecologies: How might a range of “places” and online digital “spaces” be coordinated to fulfill the social contracts of public schooling?* (p.34). I suggest that there is a significant opportunity to connect a range of learning places that provide digital access to youth in face-to-face social contexts, and that these are critical in addressing equity issues and age integration.

It is arguable whether this is a logical extension of the initial observations, let alone an effective one. Schools represent overwhelming environments for kids where they have little personal power; adults are clearly in charge in most schools, adults who are

typically intimidated by the digital infrastructure of the 21st Century, who, more often than not, are not interested in sharing their power. Transferring the excitement and capabilities of youth in the digital arena into schools may well be disastrous, let alone being an insurmountable goal.

So what are the other options? How might we build on the natural enthusiasm and interest of our current day youth so as to extend their opportunities? The tools and environments of gaming and communicating were designed for them. What other tools and environments should we consider in this genre that can give youth more power over their worlds? And are there some of these that might naturally include “learning objectives”, content and methods of knowing that can naturally engage youth and provide them with skills to navigate their worlds?

And then, given an acknowledgement of all these issues, how might we combine real “places” and virtual “spaces” so as to provide a continuum of experiences for youth and adults that are engaging and productive? How might hybrid spaces be developed where kid-centered activities share power with competent adults? How might afterschool centers and museums and libraries and homes and community centers become vibrant arenas that encourage youth learning and that engage digital tools for all? How might these places and their integrated virtual spaces provide complements to school activities? How can they do things that schools can’t do? How might they provide opportunities for deep social and intellectual relationships that many digital kids can’t find in school or at home?

You drop a pebble in a pool --- the observation that kids are engaged in spontaneous digital communications on their own --- and then the ripples spread. The opportunities and the challenges show themselves. And then it is time to jump in. There is hard work to be done, both in understanding this dynamic space, in articulating it, and in choosing both specific projects and general overviews. And there is a need to integrate ethnography (watching spontaneous activities, identifying stages of development), design (making new digital things, encouraging kids to create/express) and venue (connecting compelling real world places with virtual spaces, creating hybrid kid/adult places). For a balanced consideration of all these perspectives provides an opportunity for the understanding of what is and what might be.

4 DIGITAL QUESTIONS

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When one dives very deeply into the general arena of “digital media and kids”, or “digital kids and media”, one hits a large number of very diverse issues, opportunities, and challenges.

The four articles that follow were prepared to encourage some clarity in thinking about this emergent area while at the same time acknowledging its inherent complexity.

They are intended to raise questions, to make important distinctions, to remind us of important precedents, and to suggest promising follow-on activities.

They are all unfinished pieces that should evolve with further thinking and conversation and investigation.

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Digital Technologies as Thinking Tools: How might we enable complex thinking in a changing world?²

Introduces a historical perspective of the centrality of digital technologies in changing the ways people can think, learn and communicate. Suggests a continuous dynamic cycle between changes in tool systems and human systems, noting the methodological challenges of this continuous change. Argues that the world is changing and that youth must be engaged in this change, if not in schools then somewhere else.

The “digital revolution” in the last decade has changed the world. Personal computers, cell phones, digital televisions and internet access are widespread. Videoconferencing, windowing systems, and the mouse are part of many people’s everyday lives across the world, and their availability is spreading. The question then becomes “how is this changing how we think?” What are the implications of all these activities beyond the level of clever gadgets?

In 1945 Vannevar Bush wrote a very provocative article in the *Atlantic Monthly*. Titled “As we may think”, this article suggested that the emerging computer technologies would fundamentally change the ways humans thought and communicated. His argument, based on his experience as the Director of the Office of Scientific Research and Development, argued that there was a great opportunity in a peacetime economy to develop computer systems for giving “access to and command over the inherited knowledge of the ages”. As the Editor of the *Atlantic Monthly* writes in his introduction to the article “Dr. Bush calls for a new relationship between thinking man and the sum of our knowledge”.

Wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified. The lawyer has at his touch the associated opinions and decisions of his whole experience, and of the experience of friends and authorities. The patent attorney has on call the millions of issued patents, with familiar trails to every point of his client's interest. The physician, puzzled by a patient's reactions, strikes the trail established in studying an earlier similar case, and runs rapidly through analogous case histories, with side references to the classics for the pertinent anatomy and histology. The chemist, struggling with the synthesis of an organic compound, has all the chemical literature before him in his laboratory, with trails following the analogies of compounds, and side trails to their physical and chemical behavior.

The historian, with a vast chronological account of a people, parallels it with a skip trail which stops only on the salient items, and can follow at any time contemporary trails which lead him all over civilization at a particular epoch. There is a new profession of trail blazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record. The inheritance from the master becomes, not only his additions to the world's record, but for his disciples the entire scaffolding by which they were erected. . . .

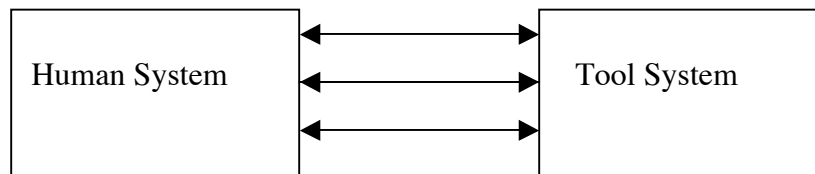
Presumably man's spirit should be elevated if he can better review his shady past and analyze more completely and objectively his present problems. He has built a civilization so complex that

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he needs to mechanize his records more fully if he is to push his experiment to its logical conclusion and not merely become bogged down part way there by overtaxing his limited memory. His excursions may be more enjoyable if he can reacquire the privilege of forgetting the manifold things he does not need to have immediately at hand, with some assurance that he can find them again if they prove important. (Vannevar Bush, 1945, Section 8)

Influenced by reading this article, Doug Engelbart extended these ideas at the Stanford Research Institute between 1957 and 1978 (<http://www.bootstrap.org/>). As is well established, during this time Engelbart and his team invented the mouse and windowing systems which are common in today's personal computers, and developed hypertext systems which are now commonplace on the world wide web. What is not typically acknowledged is that Engelbart also described in detail a context in which these devices were invented and their anticipated uses in changing the ways in which humans could think and how they could organize address complex issues. He also described how changes would come about through interactions between two quite different systems --- "Human Systems" --- the social rules for organizations, the methods of thinking, the strategies for survival --- and the "Tool Systems" --- the technologies available to the culture.

He argued that changes in tool systems would change human systems, that then the changes in human systems would change the tools systems, ad infinitum. He further suggested that one could deliberately "bootstrap" between these two systems, enhancing one to enhance the other and ever onward.



In our rush to make money from technology, to create new clever gadgets and new hardware and software innovation, we all seem to have forgotten this interaction between human and tool systems. Indeed marketing researchers do investigate what people want and need, and once there are new products that are influenced by this research, marketers and advertisers develop elaborate materials and programs that show that a new product is available to suit these wants and needs. However a widespread focus on just how our tools influence our human systems, and how we might develop and use new tools to enhance our human systems, seems not to be forthcoming. Though we have a technology which has in many cases been explicitly designed as a "thinking tool", we have not acted effectively in any concerted way to pursue this possibility systematically.

Indeed many have studied how individuals might learn differently using computer technologies. Others have created new technologies which they think can enhance learning. However, we have been ineffective in establishing organizations in which they are very tightly coupled over extended times. The marketplace has been very effective in driving the development of exciting new technologies that people love, and are convinced are central to their lives. However the general enterprise of providing technologies that are "needed" for learning and thinking has been sparsely populated.

Companies that are successful in addressing this area (and there are many well intentioned companies that have failed) seem to be purchased by others who aren't. Individuals who are successful in studying changes in learning seem to often get more interested in the technology than the details of the learning; they become engaged in popular culture and "nifty new technology opportunities" rather than learning and thinking opportunities. And K-12 schools, who one would think would be interested in tools to enhance thinking and learning, have in general proven themselves overwhelmed and fundamentally resistant to inclusion of technology in their classrooms. Whereas universities and professional domains have embraced technologies to enhance the intellectual work of individuals already quite accomplished in their crafts, there has been little significant work in incorporating technological tools into the activities of early learners and adolescents. Even word processors and general access to the web are unavailable to most young students.

Does this matter? Might we not simply consider technological tools that support thinking and learning and problem solving as the domain of "information workers" and professionals? Can't students simply learn the tools they need when they are available to them and central to their work?

Although this is the approach we have all de facto accepted, it is deeply flawed. It is flawed because it is inequitable; it doesn't provide experience with technology to all students, only those who emerge successfully from the K-12 system. More critically though, it does not acknowledge the fundamental interaction between tool systems and human systems that Engelbart articulated almost fifty years ago. For as technologies are incorporated into universities and the workplace, these institutions will change. People will begin to use technologies to do new things, in addition to using them to do old things in new ways. Preparing students in K-12 to function in these changing world without access to even simple technologies is then idiocy. The status quo is flawed because it doesn't acknowledge that the use of technologies in universities and in professional domains will fundamentally change these domains, and the people working in these domains, thus excluding entry to these areas to students who are inexperienced in thinking with technologies.

The tools change the humans. Then the humans change the tools. Surely we need to focus in early education, where we think we are training students to think and to master the accumulated knowledge of the eras before us, on this cycle.

We need to acknowledge that when information is readily available online, it is not necessary to memorize it. Vannevar Bush was able to predict this sixty years ago, and still this observation has little impact on our schooling systems. We still give tests of content mastery to people who don't have access to available online resources.

We need to acknowledge that when you can use a word processor, you can teach writing in ways that you can't without it practically. Editing and peer review and revisions can become central to the writing process. And yet we still require students to write papers by hand.

We need to acknowledge that when you can gather information quickly, on one screen, you can begin to see connections between ideas and opinions in ways that you are fundamentally unable to if you have to spend significant time locating books in libraries. And yet we have barely begun to

allow young learners to know how to seriously find materials online that might encourage their comparative abilities. We continue to teach them how to use card catalogs even when most major libraries no longer have any.

We need to acknowledge that when you can email and IM and call people on their cell phones, you can connect spontaneously to a range of individuals who can give you advice and work with you on common goals. And yet we continue to design our classroom activities as fundamentally individualistic with few if any experts available from which to learn except for classroom teachers.

We need to acknowledge that the internet can connect students to activities throughout the world. For no incremental cost, students can immerse themselves in the news of countries everywhere, reading current media and participating in online exchanges and challenges. They can expand their horizons well beyond their school and neighborhood. And yet we continue to limit students' access to these activities, maintaining an isolationist attitude that is constraining.

We need to acknowledge that primary source materials are now widely available on the web, as well as search tools that let one view opinions on these as well as the originals. And yet we continue to support a multimillion dollar textbook business that provides only bits and pieces of summary materials.

We need to acknowledge that materials on the web can be made available at scale very cheaply, and that, leaving aside server costs, one copy is as expensive as a thousand. We need to acknowledge that color and movies and images can be included in these materials, and that this will not add publishing costs. And yet we continue to fund textbook repositories and put millions of dollars into educational publishing ventures for schools.

On a wide range of dimensions which are important to thinking and learning of youth, we have reached "tipping points". Quantitative changes have become qualitative. New tools for thinking are fundamentally changing the nature of cognitive and social activities. We must acknowledge these things and stop pretending that the marketplace and basic research will somehow resolve these discrepancies.

Of course once we acknowledge these things, the work only begins. Technology infrastructures need to be developed for young people that can provide them sustained support in their activities. Individuals who are comfortable with technology use in thinking need to infuse the lives of all youth. Content materials and technological tools need to be developed and made available to all youth at very reasonable cost. Business models must be established that encourage both innovation and sustained support.

We also need to develop new kinds of methodologies which acknowledge the rate of change in the digital arena. We need to expect the technologies to change, and develop ways that our results can be valuable anyway. We need to expect that youth will change given exposure and heavy use of technologies, and find ways to describe these changes in categories that can be useful in guiding new technology developments and new educational scenarios.

In an interesting way, we need to move from arithmetic to calculus. We need to be expecting change, and we need to find ways to systematically investigate it.

And we need to keep K-12 youth in mind as we do this. For if indeed, as Vannevar Bush and Doug Engelbart suggest, digital technologies are key to human thinking and communication and problem solving, then youth should not be the last people to know about these technologies. And, given their flexibility and fluidity, they should not be ignored as primary partners in discovering just how these new technologies that are being invented might best be incorporated into productive and satisfying lives.

Opportunities and Challenges

So what does this context provide us? What are the opportunities and challenges suggested by this method of framing issues?

1. Conservatism of Schools and their Social Contracts

K-12 public schools have a strong social contract with all youth, including those that are not necessarily extremely talented and those that may see no future in schools. They also have a social contract with the society, providing an educated population that can participate productively in the future of the culture. As schools take these responsibilities seriously, they often become extremely conservative and risk averse. They are hesitant to follow fads, or to abandon approaches that are widely accepted and understood. They are settled in their ways, and loyal to their employees. They do not particularly admire the ability to be “quick on their feet”, to adapt to changing situations and demands.

In short, at their core they are extremely incompatible with the ongoing digital revolution where “change” is the main theme. One should not be at all surprised that these schools have not successfully organized themselves to effectively provide technology infrastructures and support structures for intellectual work. And one should not expect them to change.

Opportunities:

- Provide youth with access to technologies outside of schools for the long term (in homes, in public places, in afterschool programs)
- Identify those schools (public and private) that have effectively engaged technology for learning; identify the success factors and provide broad access to these “reference sites”
- Provide schools with a conservative approach to technology adaption, outlining stable safe implementations that can be sustained (eg writing labs, general internet access)
- Examine funding policies that may discourage K-12 schools from successful technology implementation (depreciation strategies, staffing instabilities for technical support), considering workplace and university models in contrast

2. Methodologies for Tracking Changes in Tool and in Human Systems

If one accepts the notion that we are working with changing tool systems and human systems, then one needs a way to describe each of these systems. One needs some elements to observe over time so as to recognize changes and new implications. Moreover, one needs a level of

analysis that will sustain across time, even as details and surface elements change. Marketing analyses do this by measuring the number of computers people buy at different price points, or the number of machines that have internet access through different services, or the demographics of cell phone owners, or the number of workshops that are attended.

What are the appropriate elements to look at if one is interested in the incorporation of digital technologies in learning outside of the commercial marketplace?

How might one best describe digital learning technologies? Cell phones? Computers? VideoGames? Internet Access? Word Processing Programs? Or should we think in terms of connectivity, mobility, text expression, image creation, simulations?

What are variables that best describe areas of change that we expect in the human learning activities? Time taken to find a fact on the internet? Number of people on IM lists? Category of projects done in collaboration over the net? Number of tasks able to perform at the same time? Interest in Learning? Time spend in academic conversations? Visualization capabilities? Friendship patterns? Strategies in working together on homework? Attention spans?

Where are the settings of interest? Schools? Homes? Chicago? Japan?

Who are the youth that we are interested in? High school students in affluent suburbs who have ready access to digital technologies? Inner city youth who don't? Heavy cell phone users?

How can one establish longitudinal studies that last long enough to assess changes?

Opportunities:

- Explore the literature to find variables of interest and existing longitudinal studies.
- Bring together panels of experts and ask them to predict changes in youth thinking with digital technology use. Establish studies to investigate these areas where change is expected.
- Conduct ethnographic studies of "advanced technology using youth" to identify variables of interest and then move to larger scale analyses
- Develop a "stage description" of how youth adopt to technologies and how they change their ways of engaging information and ideas and learning

3. Design New Things that Encourage Learning with Digital Media

Many examples of tool systems are emerging from industry as the digital market is ever increasing in size. These approaches are typically market driven or technology driven.

An alternative is to consider a design driven approach, and to develop examples of digital experiences that we judge are central to learning and important for youth development. What are the examples of things that everyone agrees is important for youth to master? And what are the kinds of activities that can take advantage of interactive, media rich, collaborative materials to attain these goals?

One finds an extremely compelling and successful example of this kind of approach in the reading materials provided by LeapFrog Inc., in their LeapPad technology and materials. The goal of these technologies is to provide a context in which all children can learn to read, an agreed upon goal of the school and non-school cultures. The technology is a complex audio computer which is highly mobile, very cheap, and quite amenable to interactions between people around the technology. The materials are very crisply designed reading materials that incorporate best practices in teaching reading.

What are other basic agreed upon goals of learning? How might one encourage industry to develop materials directed toward these goals? What kinds of activities might be designed relatively cheaply that make use of existing technologies to deliver powerful learning experiences to youth cheaply and effectively?

Opportunities:

- Talk with imaginative educators to develop a list of “what youth should know”, and develop scenarios where digital technologies might assist in this development
- Evangelize universities and industry to produce materials that target important learning objectives, adding K-12 materials to the learning objects that exist for higher education.
- Establish widely publicized contests where educators and developers team to propose great digital technology ideas. As a prize, fund the development of the best projects.
- Produce a number of “design examples” that show a range of approaches to the definition of digital learning adventures that are central to learning

4. Provide an Explicit Curriculum to Encourage Digital Fluency of all Youth

Many adolescents have developed incredible digital media saavy, immersing themselves in the worlds of blogs and instant messaging and digital movie making and email and cell phones and the internet. They are fluent, productive and engaged.

Many adolescents have not. They either have no interest, no access, or no knowledge of these possibilities.

Some of the fluidity and capability of “high digital” youth is “just for fun”. Some of it is absolutely central to survival and performance in the information age, and to ultimate success in education.

It is critical that this second group of literacy skills be made available to all youth. It is critical that these capabilities are not developed hit or miss, and that they are not restricted to individuals who are economically and culturally advantaged.

Opportunities:

- Identify critical digital skills relevant to learning by observing “high digital” youth
- Work with these youth to develop a curriculum that will provide these skills for their contemporaries that can be made available outside of schools
- Work with educators to incorporate these skills explicitly into school activities

5. Labs/Organizations that are combining work on Human and Tool Systems

It is typically the case that organizations and individuals focus on either human systems or tool systems. There are multiple disciplines that look at each --- psychologists, educators, anthropologists, sociologists attend to human systems whereas computer scientists, product designers, and engineers care about tool systems --- but there are only occasional individuals or places that focus on the interaction between the two systems. Groups do inform tool developments by attending to information about humans, and vice versa. What is infrequent is attention to more than one cycle between these two, and balanced approaches that care about both systems rather than using one to inform the other.

Opportunities:

- Identify places that consider work on the continual evolution of Human and Tool Systems and understand the methodologies that they employ
- Provide opportunities for discussions between groups who are engaged in both systems at the same time
- Look to groups that have capabilities in both arenas to work on projects



Where in the World is Carmen San Diego: Where is there a place for transformational learning software³

Provides a brief review of the Apple Multimedia Lab (1987–1992), describing an outline of the activities in the exploration of interactive digital media for learning. Acknowledges the technological and design success of the Lab, but bemoans the lack of impact of new digital design opportunities in schools. Briefly describes how other innovative learning software has similarly been ignored by schools, and how the current business models do not encourage continuing innovation in this area.

In 1987 Apple Computer, Inc., established the Apple Multimedia Lab. Launched in anticipation of the new product “HyperCard”, this Lab was established as a market development effort to introduce new kinds of “interactive multimedia” products for education. It also had a research agenda, investigating how new interfaces and uses of media for education might suggest new kinds of technologies.¹

HyperCard introduced a wide range of new traditions to the educational computing environment. It was a very powerful “linking tool”, bringing the research notions of “hyperlinking” from the arenas of research labs to personal computers. (Doug Engelbart and Ted Nelson had independently developed interlinked materials twenty years earlier). It also had multimedia functionality, being linked to movie and audio elements. And it had a personal programming capability, giving students and teachers as well as developers the ability to create “interactive multimedia” presentations.

The goal of the Multimedia Lab was to bring the best traditions of earlier research computing to the Macintosh computer, and to show the possibilities of combining computers and media and content to provide compelling and effective educational experiences.

During its five year existence, from 1987 – 1992, the Lab introduced a range of “design examples” which showed how interlinked, media-intensive products might be designed that engaged youth in intensive educational experiences around content areas. It developed these design examples with a range of development and publishing partner, partners who could leverage their content and their media savvy in creating well respected, solid educational products. It provided Lab tours for thousands interested in new media, and training for hundreds of interested people. It’s location in San Francisco, in an old garage where space was shared with non-profits including the Moscow Teleport, provided the seed for the development of Multimedia Gulch in San Francisco, from which much of the dot com world exploded.

National Geographic partnered to create “Geography TV”, a geographic exploration of the USA, along with Lucasfilm Ltd.. The National Audubon Society partnered to create an environmental title investigating the disappearing wetlands. Scholastic worked with the Lab on a product examining the US Constitution. An investigation of DNA --- Life Story --- was created in collaboration with

³ This essay was prepared with support of the MacArthur Foundation as part of the Digital Kids and Media Project, August 2004.

Adrian Malone, the Smithsonian and Lucasfilm. A set of materials connected to the Grapes of Wrath were organized by a local high school teacher and librarian with support from the Lab.

Videotapes of these design examples met with “great critical acclaim”. Teachers and administrators were excited by the possibilities of having available great speeches of an era, and solid lab experiences. They were impressed with the abilities of students to engage difficult ideas in a compelling context. They were astonished at the possibilities of creating their own multimedia “essays”, combining linear video and images and sounds into new compositions.

Technology developers were intrigued by the ideas of combining images and sounds and texts, and in bringing movies into the computing environment; they were motivated to develop cost effective technologies that had the memory required to handle large files and new digital technologies that might allow “video” to become part of the computing environment.

Software publishers and school textbook publishers were taken by the opportunity to reach new markets and to engage new techniques in delivering their materials. Conference planners jumped at the chance to provide large scale technology conferences heralding the new multimedia revolution, the new challenge to the printed page, the next Gutenberg era, the next million dollar business.

In the midst of all this hype, Apple Computer, Inc. introduced a range of new processors that could better handle multimedia content, it began to include CD-ROM drives with its computers, and it invented Quicktime --a standard for digital media. The Lab introduced a range of products that were based on its design examples, initially with HyperCard videodisc combinations and soon on CD-ROMs.

It was an exciting time. It was a productive time. Overall, it was a very successful time.

Imaginations were stimulated. New technologies were created. New businesses were launched. New software was designed.

However, the interactive multimedia software products introduced during this time were ultimately failures, especially if considered out of context. Many products won numerous national and international awards. They were included in many keynote speeches. They were important in building momentum for the sales of computers to schools. “They were met with great critical acclaim”, yet they sold only a few thousand units and are probably not being used ten years later in many schools. Though a few of them can still be purchased (many publishers have disappeared), they have not been updated and are no longer even known by new editors.

Some of the failure of these products can be attributed to technology changes. Early videodiscs were awkward, and have been replaced by DVDs and CD-ROMs. Those products that were CD-ROMs became part of the boom and bust of the CD-ROM explosion in the late 1990s, when the internet offered the promise of free materialsⁱⁱ and changed the business models for educational software. The consolidation of the educational publishing business into two or three major companies more interested in “hit products” than substantial new development in recent years has also had its impact.ⁱⁱⁱ And the changes in operating systems on both the Windows Platform and the

Macintosh platform has left behind many products that were not profitable enough to warrant upgrades.

Each of these business issues are important to consider. They certainly contribute to the lack of success of many interactive multimedia titles. In theory, these issues should sort themselves out as standards are developed and distribution of software becomes more mature.

However, I don't think that these categories of products will become successful even when all of these issues are settled. For there are more significant obstacles to the adoption of these categories of "transformative products", as the inertia of the past weighs heavy, not unexpectedly, on the development of future opportunities. Attitudes, habits, and personal experiences are the primary obstacle to success. This is most particularly the case in schools. For to engage multimedia titles in schools one needs to change the organization of classrooms and ideas about what is important to know. One needs to accept that video segments can be important for academic development, and that under user control short video clips and other "non-movie" video can be very effective in conveying difficult concepts. One needs to have assessment methods that acknowledge the importance of collaborative contributions and projects. One needs time for students to engage projects and spaces for them to work on teams. One needs teachers that are comfortable serving as coaches and in handling equipment. Etc. etc. etc. (Interestingly this list looks very much like those that advocates of school reform carry on their shoulders. The compelling question is whether these titles can wait for school reform, if they can be reinvented then. Alternatively, might these titles be powerful agents for this reform, something that leads rather than follows the reform?)

Once one entertains these notions seriously, it becomes clear that this "fitting into current practice" vs. "providing a future vision" tension is a factor in many many educational technology innovations that have not been widely embraced by the educational establishment. These same kinds of shifts in classroom practice are necessary for other classes of educational software to be engaged in schools. We have all been focusing on technology infrastructures and teacher techno-phobias and teacher training, and yet it may be that even when all this difficult work is accomplished there will still be no broad adoption of educational software beyond that which fits easily into standard models of schooling (for example skill building in basic reading and arithmetic for elementary students and writing/researching for older students).^{iv}

For example, though there are many solid educational software titles that are fun and engaging ("educational games"), these are typically not included in schools at all except perhaps as "supplemental materials". The entire "Carmen San Diego" series originally produced by Broderbund ("Where in the World is Carmen San Diego?", "Where in the USA is Carmen San Diego?", etc.) is rarely found in schools, though the fanciful context provides great experiences for kids using reference materials to find information that can help them solve mysteries. Even the "Zoombini" series, which focuses on math principles and is developed by a non-profit who was highly involved in mathematics education, is not central to schools. Many youth have these products at home, and find themselves "learning by playing", but general school access is not available. ("Oregon Trail" is an exception to this, being often included in schools because its content is often in the curriculum. I think this is probably the only exception though; you'd think that someone would follow up on this seemingly widely accepted idea of a game motivating curricular

units. Perhaps in this case it is a matter of qualifying these categories of products for funding by the schools.).

Another impressive category of educational software --- “simulations” --- is also not widely accepted in schools. Though the SIM series has achieved notable commercial success, and SIM City is often rightfully pointed to as an example of how computers can encourage new kinds of important learning, it does not fit readily into curricula and so is not widely adopted. General simulation programs like “Cocoa”, developed initially at Apple Computer, Inc., and then offered by a new company named StageCast, have also been remarkably unsuccessful in the educational marketplace.

Another element of educational software that has almost disappeared from schools is “programming software”. Even LOGO, the software programming language that pretty much launched the entire field of educational software when Seymour Papert introduced it as an environment to encourage childrens’ thinking, is not available. BASIC, a programming language developed at Dartmouth many decades ago, is also unavailable, and there is no replacement for an easy entry programming environment that all youth (not just those interested in programming) can engage in order to understand the logic of programming. Hypercard is no longer available, and HyperStudio, its school oriented derivative which enjoyed initial acceptance in innovative schools as an interactive multimedia linking tool, has not gained mainstream acceptance.

“Authored presentations” have also not survived in the educational marketplace. Robert Winter’s incredible musical software that provided compelling analyses of great symphonies has not only not spurred development of more such expert titles, but it has disappeared from the marketplace. “I Photograph to Remember” by Pedro Guerrero, which showed images of his mother’s death, brought tears to the eyes of so many at early multimedia conferences. Though it convinced those in attendance that emotionally charged materials could “live in computers”, it did not create a genre of similar personal expressions, and it is no longer available. Voyager Publisher, an innovative publisher directed by Bob Stein, which introduced these works has also disappeared. Though we now have tools that students can use to create image-rich and sound-rich computer presentations, we are lacking the expert presentations that provide models for the form of such presentations. And we have not accumulated a set of interactive environments that are building toward a “bookstore” full of professional expressions. It’s as though we invented writing, witnessed a few great novels, and then decided that since we knew of the existence of this media form, there was no reason to create any more such records.

It is rather an astonishing situation. After a number of decades of promising innovation in this area, and predictions of major business successes, the skies have darkened. Old exciting products are no longer available as they have not been updated for new technologies. New titles are not being developed as publishers are focused on sales of existing hits. Schools have not been congenial to the introduction of most new technologies, and computer materials have not significantly changed schools.

We seem to be currently in the Dark Ages of educational title development.^v The ideas behind earlier innovations are disappearing, as are the examples. Unlike old books and movies, there are no archives available for rediscovery. There is no migration of early titles to new technologies, and old machines which can read the old materials are disappearing. It seems that many innovative

titles have failed because of the success of their vision, as they created expectations that were too big, and business models that were too greedy for the realities of a new medium that lacked established conventions and technology standards.

Perhaps this is a reasonable outcome. Perhaps the promises of all these innovations are misleading. Perhaps our hopefulness has overwhelmed the clarity of our vision. Perhaps if we are patient the best of these kinds of activities will reemerge spontaneously. Perhaps, like the videogame industry that was given up for dead with the fall of Atari in 1984, and reemerged even stronger with the introduction of Nintendo, PlayStation and GameBoy, the educational software domain will rise from the ashes around a new platform that is more flexible, mobile, ergonomic and inexpensive. Perhaps it was foolish to create high quality educational materials that did not match the schools, and perhaps schools will change and will demand these kinds of materials. Perhaps I am so completely out of touch that I haven't noticed that the Renaissance in this area is already well underway!

I'm not convinced of any of these things, unfortunately. Unfortunately because it makes me keep trying to think of ways that new kinds of learning opportunities might be designed, that lessons from earlier activities might be passed onto a new generation, that schools might be organized to embrace new materials, and how innovation in the design of learning products might be encouraged.

I don't think this is a technological problem. I think that newer faster mobile technologies will emerge that encourage more and more social networking, and that they will be more and more congenial to media-rich collaborative learning activities.

I don't think this is ultimately a distribution problem. I think that the internet provides a method of distribution that suits educational software quite well, and that it provides the possibilities of well organized and articulate "points of download".

I do think there are major business issues involved, most notably the development of a business model that allows for the development of a number of low cost titles, for a number of experiments, and for some significant high investment reasonable risk products with a significant market. I do not think that the commercial marketplace will support this in the near term. On a good day I think that movie making, and its clear distinction between "Hollywood hits" and independent films, offers us a reasonable model. On a normal day, I realize that the entertainment will not generalize to the social change of the education "business" (and that indeed there are many elements of this business that I am pleased to keep at arm's length).

I do think that there are major obstacles to design success, and that the complexity of material development that combines aesthetics, usability, and effective learning can be overwhelming. Moreover I think there are few individuals or groups who have professional talent in these multiple areas. I also think this can be overcome.

I do think that these kinds of products can be culturally transformative, in a good way. I do think that a combination of good design, good pedagogy and good ideas can create learning environments that are at once engaging and effective for youth, that make difficult ideas accessible

to many with ease, that work well with great teachers yet that work quite well without them, like a good novel.

And finally, I do think that with all the business, technology, design, and evaluation challenges inherent in these kinds of products, the hardest challenge is to impact schools. And, that unless one has a strategy for doing this, one should be clear about the limits of ones ambitions.

Where in the World is Carmen San Diego? At the moment she is frolicking across the screens of many kids at home who happen to own computers and have parents who value learning. She doesn't see much work in her future, she's at the end of her product line. She will be upgraded but she won't be refined or reinvented. Of course maybe she is pleased by this outcome. I'm still not sure I am.

Opportunities and Challenges

So what do these ramblings provide us? What opportunities and challenges are central to this set of issues?

1. Innovative Learning Software

Publishers seem more interested in selling current products than inventing new ones. Technology companies that have supported educational software development in the past no longer do this because there is no longer the need to provide consumers with demonstrations of their products' effectiveness. Engagement with the idea of a "new medium" has faded, and most seem to assume that the worlds of television and computers and print have come together as well as needed, on the internet and in entertainment venues. Yet further innovation is required to advance this field if it is to serve educational intents.

Opportunities:

- Identify locations that are producing learning software, in universities, research labs and commercial ventures. Determine where the innovation is most promising and provide some support and "publicness" for these ongoing activities.
- Establish partnerships between developers and content providers to produce "design examples"^{vi}, inexpensive design sketches produced in a month or two that show an important idea to youth. These can be collected as examples; assistance in finding funding for full development might be provided to the best examples, perhaps by providing an internet site that highlights these. Established curriculum developers (my favorite is "Everyday Math") should be considered as partners in these ventures.
- Explore how products that exist on personal computers might be augmented with newer smaller mobile technologies, including activities involving cell phones, instant messaging, and other popular communications devices. Examine web activities that do this now and assess their value for the educational arena. Examine early Apple Computer, Inc., demonstrations, including "Aspen" and "Wireless Coyote" for early models of mobile learning adventures.



2. Things of Value

Though it is easy to note that there are a range of “unavailable products” there certainly are a number of educational technology products on the market. There are also some copies of “old classics” hidden in odd locations. And there are also a number of magazines and educational reviews of products. However, it is difficult to determine which of these are “things of value” that all youth should experience. So much of what is judged important is commercially driven or driven by what is “new”. It would be nice to explore what the status of this area really is, and to revive some old classics and see if they actually are interesting at all!

Opportunities:

- Review existing reviews and determine criteria for classic products
- Develop a “top ten” list of classic products by interviewing and/or surveying leaders in the field and make this widely available. Maybe have a top 50 if there are many truly valuable titles located.
- Develop a language to describe very different kinds of educational technologies --- eg programming languages, simulations, construction kits, educational games ... noting the intents of these kinds of software.

3. New Genres of Media Use (Provocative Object Explorations, Annotated Movies, Alternative Examples and Alternative Viewpoints)

In early explorations of interactive multimedia, a range of different genres of product were discovered/invented. Amongst these were four that I have always found to be very effective and quite inexpensive/uncomplicated to produce.

The first I will term “Object Explorations”. The late Bob Abel developed a number of these for IBM, including an excellent product on Picasso’s Guernica. The simple wonderful idea is to take a single object that has powerful significance and attach to it all the elements that show its rich context. You can include a description of Picasso’s life. You can have movies showing the horrors of war. You can have descriptions of the Spanish Civil War. You can examine how this piece lived in New York at MOMA for so many years before it was allowed to be moved to a different museum. You can examine the role of artists and museums in showing cultural issues. Or, as Bob did, you can interview people who were in the small town of Guernica when the Spanish Civil War was fought there. In addition to choosing these for dramatic effect, one can guide the connections to match educational standards, doing this quite differently than other more standard presentations. (Other objects might include the Declaration of Independence, a strand of DNA, a lever, an Emily Dickenson poem, etc).

The second is the category of “Annotated Movies”. At the Apple Multimedia Lab we produced a product titled “Life Story” in 1989 which demonstrated how a powerful movie about science (a BBC movie on the discovery of DNA) could be annotated so as to provide classroom value. It was remarkably successful in high school classrooms and received numerous awards. (Rob Semper was one of the key designers on the project). Though difficult to conceptualize initially, this product

provides a template on how to take advantage of linear narratives by taking them apart and adding to them to suit the needs of classrooms.

The third category is “Alternative Examples”. This was best illustrated, in my experience, with the Stanford University Project by Larry Friedlander titled “From Page to Stage” (coordinated by Michael Carter). Friedlander had a number of elements in his project that addressed the differences between written texts of plays (for example of Shakespeare) and their performance. In one section of the product he showed a number of different performances of the very same texts. Seeing these close together made it possible to very easily understand his underlying concept. It also introduced a very simple technique to let students understand the very many solutions to the same proposal or outline.

The fourth category is “Alternative Viewpoints”. We used this approach often in interactive multimedia presentations, illustrating alternative competing views of the use of wetlands between duck hunters and environmentalists, for example, or different views on school reform between parents, administrators and teachers. One can do this simply with short video clips distributed on a blank surface, not unlike magnets on a refrigerator. Or we developed some “hand raising” caricatures that allowed one to simulate arguments.

Opportunities:

- Make some design examples using some or all of these genres. If they prove to be as simple to assemble as thought with new tools, build some templates that others can use to create such presentations (or evangelize commercial tool makers, for example Macromedia, to include features in their products that make these presentations simple). Make the materials created readily available on the web.
- Provide tools that allowed students to add new materials to these prepared presentations, and provide activities that include student groups connected with IM and cell phones to work together in creating new resources.
- Encourage professionals (eg environmentalists, historians, biologists) to create products using these templates in areas that are important for youth to learn.

4. Assessment

Many educational software products “look like they are valuable”. They seem to represent important ideas. They are compelling and fun to use. They take advantage of new possibilities with technology. They appear to stimulate imagination. However, we need more data on a range of products in order to be more confident that these products are worth the investment in terms of the education youth gain in using them. We need to develop tools that help us distinguish attitudinal and performance measures (both being important). We need ways to assess dimensions like “critical thinking” and “problem solving ability” in order to be sure that these kinds of skills are truly developed by this new wave of product.

Mindful that most textbooks and other school materials do not undergo such scrutiny given their accepted role in the classroom, it is still important to develop a language that communicates to

teachers and learners alike just why the incorporation of digital resources is important for learning, what can be expected from them and what can't.

Opportunities:

- Survey existing studies of individual software packages and summarize results. (Are there studies on individual packages?)
- From reviewing available studies, determine a methodology that is cost effective and broad based that can provide objective feedback on learning software.
- Interview experts to find out just what they think educational software provides well, to whom, and what one might expect from it in what contexts.

5. Historical Context and Design Insights

There are a lot of “old fogies” walking around talking about the demise of educational software innovation, and about the “good old days”. There is a lot of talk about the “old classics” that were better than anything produced now, most of which are unavailable for view. There is a lot of concern that the lessons learned with early innovations has not found an effective vehicle to survive or to be passed to the next generation. (This may be overstated. It may be that the early innovations in this area are better forgotten and that we should begin again anew in a new technological and business context.) There may be some important lessons that can inform new work, ideas that are not publicly available because the cultures that created them were either proprietary or they were too design oriented to be interested in publishing their work.

Opportunities:

- Follow through with a group of students at Stanford who began an accumulation of “classic old educational products” about three years ago, and see how successful their endeavor was.
- Hold a meeting with some of the “old timers” (Joyce Hakkanson, Tom Snyder, Seymour Papert, Bob Stein, Marge Cappel) and try to identify both what some of the great ideas are, and how they might best be collected.
- Commission some essays, papers and maybe a few books describing early innovations in this field. Look for existing publications and make those discovered widely available.

6. Non-profit and Ancillary Product Development

Though commercial publishers may not have not been developing substantial educational software products over the last decade , many groups have designed materials for the web which are explicitly educational. Many non-profits, for example the Exploratorium and the San Francisco Museum of Modern Art, have identified the web as a primary distribution mechanism for their general educational missions. They do not produce “educational software products” in anticipation of direct monetary profit, but instead as part of their portfolio of services and materials. Interactive media has been substituted for budget line items that in prior times might include books or brochures. Though many of the educational materials on the web lack significant interaction and are considered as add-ons (speaking from the experience of judging the education category for the Webby's for the last few years), there are some high quality educational materials that have

emerged on the web from new kinds of entities (eg not educational publishers, not technology companies, not curriculum developers).

Opportunities:

- Identify those groups and materials that are producing high quality digital materials
- Work with them to organize their products into frameworks that are accessible and valuable to teachers
- Put together a small conference describing some of this great work and creating a report of this conference
- Provide seed funding to some of these groups to elaborate their products in ways that can be even more valuable to youth, with a focus on out of school contexts

7. Theoretical Context

There are occasional discussions of the engagement of multimedia titles or other educational software from theoretical frameworks, but this is not typical. Similarly there are some theorists who do consider emerging technology products, but often the knowledge of the products is sketchy. It may well be that theories of human abilities will need to change with the understanding of these new kinds of products, that symbolic capabilities often ignored become powerful predictors of cognitive functions. It may be that insight into theories of human thought can also more systematically guide effective product development. Yet individuals interested in applied and theoretical domains often do not interact.

Opportunities:

- Bring together a small group of people who are familiar with both approaches and determine methods that might unite these communities.
- Choose a few simple situations and provide an applied and a theoretical description of what is going on in order to communicate this problem.
- Examine current theories of learning science and see which are the most relevant to design developments and vice versa.

ⁱ I co-founded the Apple Multimedia Lab with SueAnn Ambron. I was Design Director from 1987-1989. and Lab Director from 1990-1992, The Lab reported first to Apple Educational Marketing and then to the Advanced Technology Group (and Michael Carter) in the R&D organization.

ⁱⁱ The internet has provided many “educational materials”. However most of them are text pages, with layouts that mimic magazines. Where there is interaction it is typically very primitive, often in a

question/answer format. Video is generally omitted, most probably because high bandwidth cannot be assumed, but often because it is expensive and unfamiliar to most educational developers. There have been exemplary efforts in development of java-based learning objects (<http://www.merlot.org>). However these are typically oriented to higher education only, they are of highly variable quality, and targeted very narrowly.

iii I recently found the following description of Sunburst Publishers, one of the “old time respected” educational publishers. It gives a sense of the changes in educational software publishing brought about by the incredible predictions of profits, and then the rapid changes in the business: (Note: I have heard that 90% of the educational software is now controlled by two companies. RiverDeep is one, I’m not sure of the other now.)

Sunburst Technology develops and distributes supplemental curriculum materials for the school market. Founded in 1972, Sunburst emerged as market leader in 1983 by releasing the widely-adopted Voyage of the Mimi. Supporting this interdisciplinary, multimedia product with instructional software, Sunburst began to build a strong presence in the ed-tech market with a philosophy of creating stable and reliable programs for schools. Focusing its business on math and instructional keyboarding programs, Sunburst is best known for the Type to Learn® series and award-winning business simulation programs such as Hot Dog Stand: The Works and Ice Cream Truck.

Sunburst acquired Tenth Planet® in 1998 supporting the development of their skills-based early literacy and elementary number, fraction, and geometry programs. In 1999, Sunburst was sold to the Houghton-Mifflin Company, who brought Math Arena®, the Little Planet® Literacy series, and the Curious George® titles to the product line.

Sunburst received the EdNet Hero Award in 2001 for making a positive impact in education through learning technologies. That year Sunburst, as part of Houghton Mifflin, was purchased by Vivendi Universal. Creating a partnership with Knowledge Adventure® School Division, a Vivendi Universal company, Sunburst began to distribute popular brands such as the Jump Start™ Learning System and the Math Blaster™ and Reading Blaster™ Series.

In 2002, Houghton Mifflin divested Sunburst Technology, which then merged with Educational Resources to form the Sunburst Technology Corporation. In this transaction, Sunburst retained ownership of the HyperStudio® brand. In 2003, Sunburst's health and guidance video and print division joined School Specialties, Inc.

I also found it interesting that RiverDeep now controls many of the “old brand favorites”:

Dedicated to Education

The Riverdeep family includes award-winning educational materials from The Learning Company, Edmark, Teacher Universe, and Broderbund. You won't find a more comprehensive offering of e-learning solutions elsewhere.

I was also amused to learn that Computer Curriculum Corporation, the early entry into the market with Suppes' research programs and then substantial infusions of new talent from Apple Computer, Inc., seems to have morphed into another faceless integrated learning company (which seems to be based on worksheet distribution online, as suggested by the screen shots provided by the "new" Pearson company):

Computer Curriculum Corporation (CCC) was, at the time of the Mediterranean journey, the leading provider of educational software and services to the school market, and a unit of Simon & Schuster. In cooperation with BikeAbout, CCC designed an interactive project that was published on CCC's now-defunct, but award-winning education Web site, CCCnet, to provide K-12 classrooms with additional timely information gathered during the BikeAbout journey and to enable students to communicate with the BikeAbout-the Mediterranean travelers.

Unfortunately, the material developed as a result of the BikeAbout-CCC collaboration is no longer available.

CCC is known today as [Pearson Education Technologies](#), which used to be called [NCS Learn](#).

^{iv} It is important to acknowledge that there are a large number of educational software products that have been successful.

For one, a number of excellent software tools --- word processors, spreadsheets, movie making software, graphics packages, internet retrieval engines --- have begun to be incorporated quite effectively into learning activities in schools. Even though this software has been developed with professionals in mind (secretaries, financial consultants, independent film makers, graphic designers, "the public"), schools have adopted this "tool oriented software" to encourage youth to express their ideas --- to create textual and image-rich records of what they have learned --- and to do basic research on the internet.

In addition, a number of very comprehensive software systems (integrated learning systems) have been adopted which support elementary and high school students in mastering basic skills. Though not much different than worksheets, these programs provide very carefully sequenced activities that can be individualized based on the skills of the learner. They can also provide in

depth assessments that can assure students are learning and to guide their future progress. Most importantly probably, they provide a context for very focused activity and practice, practice and practice. These programs have found notable success in underachieving schools.

The question is, why have these product categories had reasonable success whereas the interactive multimedia content oriented titles have not?

The answer to this question that I have found the most compelling (and depressing at the same time) is that these software products fit into the established methods of schools.

Software tools, for example, have simply replaced other more primitive tools that are common in classrooms. "Writing Centers" and "Library Time" have been expanded, as youth have begun to use powerful electronic tools to accomplish that they did before "by hand". These were areas already established in schools that simply converted to "new ways to do old things".

The good news is that in many cases the methods of writing and research have changed by the introduction of a new tool. Writing can be taught very differently when revision is very simple and peer editing is possible. Storytelling can be expanded when images are available. Research methods can be elaborated with the wide range of resources available on the net. With experiences, these tools have encouraged "new things to be done in new ways".

The bad news is that in many cases these tools have been engaged by schools without changing the ways in which these skills are learned. For these tools do not, by themselves, convey how to write or how to create a story or how to do research. They require detailed curricula and they require inspired teachers who are not afraid of these new tools and all the technological overhead they require. Only the most aggressive schools have provided their students with these self expression and research tools in a seamless manner, allowing them "anytime any place" access to technology tools to support their work in all of their classes.

In sum, these tools have made good schools and good teachers better, but they have not had much of a positive effect in general on average or poor schools and teachers. Even when there has been substantial financial investment and a major political will, the incorporation of these tools has not accomplished the educational success that one would hope for that one sees in the incorporation of software tools in elite schools.

The situation for the integrated learning systems is just the opposite. Though they too fit into the current definition of schooling, they have been widely adopted by schools that do not have substantial success already. And they prove to be successful as "standalone" programs, quite independent of the immediate context. There are substantial research results that show that students' skill levels, particularly in basic skills, increase as measured by standardized texts.

The problems with this use of educational technology are then different than that of the tools. My main problem is that they don't take advantage of the technology, basically substituting for worksheets in the classroom. However, I do find it impressive that computers can work so well as "page turners" and "monitors", and am pleased that this focused context improves youth's basic skills. And it is a great thing that these programs work independently of context.

However, like tools, these uses of technology do not fulfill the promise or the hope of educational technology to support new ways of thinking and accessing information. And they don't change the way schools work generally. Though the successes should be appreciated, it doesn't seem like they provide us the extensible model we need for enhancing educational success for all. Simply providing more schools with computers, to image and text self expression tools and the internet, and to integrated learning systems may not have major positive impact in schools. They don't necessarily change how classrooms are organized or how information work is accomplished.

^v LeapFrog is an important exception to this statement. This audio-intensive, reader-centric, mobile-computer-toy company has been notably successful both commercially and in its learning effectiveness. It seems to be a technology that is moving from the commercial home sector into schools and broader arenas. Just this morning the SF Chronicle ran a story describing how thousands of Leap Pads were being sent to Afghanistan to provide information about health care to illiterate populations. Early innovations in the area of hyper-linked audio systems from Discus Books seems to have advanced to mature products in this instance.

^{vi} Design examples were key to the methodology of the Apple Multimedia Lab. Our framework, working with tools that were very primitive compared to what is now available, with designers who had to invent everything, was "three months, \$50K". A number of our design examples moved into product development.

1000 Monkeys at Typewriters: How might we encourage digital design fluency?

A very small attempt (a digital question still “frame”, not even yet a digital “fragment”) to point out a range of conceptual confusions in considering the power of new digital tools. Begins to distinguish the spontaneous use of digital tools, the development of communications and design skills required to maximize the use of digital tools, and the careful design of learning activities to encourage intellectual as well as craft learning with these tools.

iMovie and other non-linear digital movie editing programs now provide youth with the capability to create movies that were not possible in past decades by individuals who did not have great economic and technical resources. New software and templates allow youth to design web pages, including images and text as well as movies.

This is all “fun”. It is exciting to watch young people who are excited about what they are doing. And it is nice to have moments where older people are astonished by the brilliance of youth in doing things that they wouldn’t ever attempt.

It is important, however, not to confuse these activities with movie making and web design, and not to confuse them with learning activities. There is an established tradition of design and craft underlying the professional versions of these activities that is typically not being articulated for young people. Moreover after the initial invention and storyboard, most activities involved in creating movies or web pages --- even in an area of dense academic content --- is a production activity, not a learning activity.

There are a number of issues involved here that need to be untangled.

#1. The craft of movie making

There is a well established craft of movie making that has been developed over the last hundred years. Though most people are well skilled in watching movies, few have had any formal training in their construction. It is rather odd that we ask students to create movies without any experience in movie making. It is like giving a hundred monkeys typewriters and hoping that they will write a coherent essay. It’s like believing that word processors will magically transform youth into great writers. When movie making is used in classrooms or afterschool programs, it should include a systematic introduction to the basic techniques of producing a compelling movie (in addition to how to use the software program).

The movies that students make with such training can be magnificent, humorous or heartfelt or outrageous. Those that are not are uniformly incoherent, as should be expected from individuals who are given no guidance. Of course there are always some youth who have “great natural

talent". Still, these individuals need training even more. And those that are not naturals need some attention if they are not to just fade into oblivion, gaining nothing from hours and hours of production diress.

#2 General design curriculum

Underlying a movie making curriculum is a general sense of "design literacy", the ability to invent systematically with images as well as text and three dimensional forms. It is noteworthy that students do not have explicit training in this general arena in school. The American culture (as opposed to the British culture that supports an elementary design curriculum, for example) seems to distinguish greatly between academic areas and design areas. Though arguable, this is not acceptable if one is to require students to create visual products, either as web pages or movies, as classroom projects. Though images are clearly compelling to youth, and one should take advantage of this interest, it doesn't make sense to require students to "show what they know" in media they have no training in.

#3 Pre-production and Production

If one wants to become a movie maker then it is critical to both struggle with pre-production (the planning of a product, the delineation of the concept) as well as with production (the refinement of technical issues). Programs developed to train young film makers should focus on both of these issues. However, if the issue is to have students express their idea about some particular content, then the focus should be on pre-production and not get too caught up in the craft of movie making. Given that this difference will often make the difference between a one day and a two week project, it is important to enter full scale production with some thoughtfulness and to distinguish very clearly between these two kinds of focus.

#4 Non-linear movie forms

Interestingly, when computers allowed non-linear editing, we harnessed this strength to create linear movies. For linear movies are the media forms that we are all accustomed to. However, there are many other uses of "video clips" than as segments in linear movies. They can be short clips on a computer screen that can be clicked by choice by a viewer. They can outline chapters or list of ideas rather than develop an interconnected narrative. Many of these alternative movie forms may be more conducive to self expression and to learning than linear forms.

#5 Learning

You learn a number of things when you make a movie, even a short one. You learn perseverance and planning. You learn about how to work in groups and how to distribute decision making authority. You learn to make do with what you have rather than what might be ideal. You learn to visualize and to refine your visualization. You learn to communicate effectively. You learn to focus. These are all wonderful things to know how to do. Providing youth with tools that engage them in these kinds of opportunities is very important. However, when asking the question of whether movie making is important for academic learning, then one needs to be clear about what the nature of the content is, what the focus on the pre-production research is, and what the goal of

the presentation is (sometimes the making of the movie is much much more valuable than the movie itself!). A movie making program that shines in an afterschool center might then be completely inappropriate in a school. Or a student who is a master in a movie making curriculum may have great difficulties with academics in schools. One can harness success in one venue to enhance success in another on occasion, but one needs to be clear about the difference.

Opportunities and Challenges

There are a range of issues that buzz about the general topics of new media, movies, non-linear editing, design curricula, design for the digital age, learning by doing, project based learning, etc. The challenge it seems is to both notice “how this swirl is going” and “where it might go”.

1. Movie Making Curricula Around Ideas

USC has an excellent media training program for teens (that has been employed by the CORAL Afterschool programs in Pasadena). They outline a structured program for going from idea to visual representation that has proven very successful with underserved youth. One could provide support to this group (and others like them) to make their materials available to even larger groups, through workshops and online tutorials.

2. Design Curricula

I co-authored a multimedia title in 1995 titled *Vizability* which was reintroduced in 2004 by Course Technology: <http://www.course.com/catalog/product.cfm?isbn=0-534-49456-0&CFID=747911&CFTOKEN=78654425>

It was an attempt to take a design curriculum from the Engineering School at Stanford and make parts of it available in digital form for adults. The argument for this product was basically that there were new digital tools emerging that would make design a more central problem solving arena, and that everyday folks, as well as pre-professionals, would want to know how to see, draw, diagram and imagine to communicate their ideas.

It didn't focus on digital tools, but instead on general design skills that would ready one for digital tools. It didn't focus on K-12 kids in its text, instead considering a general adult audience (including students in design and communications programs in universities).

That being said, there are a number of elements in this product that are very applicable to youth, that one could extract and surround with “kid projects”. A “VizKidz” product could be created that considered more directly just what design skills kids need to work with digital media (independent of particular craft knowledge and software program knowledge).

One could probably patch together a number of elements from VizAbility with other materials that exist on the web, producing materials that tie together professional design issues and new media opportunities for K-12 classrooms.

I also suspect that Apple Computer, Inc., and others have already done similar things in their launching of iMovie. Perhaps a contribution could be made by bringing these together in a more visible way.

3. Design and Learning

There are a large number of different meanings that people ascribe to “design”. Some of these meanings overlap with learning. Some of these overlap with what is typically meant by “academic learning” or school learning.

Sometimes we use “design” to point to a way of thinking, so for example “designing experiments” in science or the social studies. Sometimes we use the phrase “design” to mean a particular set of production activities, so for example graphic design or architectural design.

Many have tried before to define “design”, and to deal with these inherent ambiguities. We should look at design and learning activities and determine just which of these are relevant to the emergence of digital technologies, and which are key to kids’ lives, and which fit within schools. At one extreme, we may advocate design programs outside of school, with no academic emphasis, to prepare students with the information identification and organization that they will need in schools. Or we may suggest that design should be conceived as a basic driver for academic goals and put it at the middle of school programs.

A conference or a book or a set of articles or a set of well organized case studies could help out these kinds of endeavors.



Distributed Learning Ecologies: How might a range of places and online digital spaces be coordinated to fulfill the social contracts of public schooling?

Another very brief description (a digital frame) of a potential conceptual confusion. Points out the importance of considering a learning ecology, a range of institutions and media, in considering how students might learn, more specifically how their learning might be supported with and encouraged by digital environments. Points out how currently popular out of school programs vary greatly in their focus and approach.

Youth have forever had extensive amounts of time outside of school, and for most, the most important times are out of school. It's time with one's family, with one's friends. It's time spent pursuing what youth is interested in rather than what adults are interested in. In the summer it is an active time, well away from books, except those that somehow warrant reading at the beach. It is time getting better at sports or musical performances or other active group oriented challenges. It is also a time for being bored and wasting time and getting in trouble. And for many, a time to work.

Somehow, in the last decade or so, educators have become enthralled with the opportunity available with all of the time youth spend outside of school. It is the grand new discovery.

In some cases, this is the result of failing school systems. As students are unable to master schoolwork during school time, it is very tempting to provide "more school time" to get the work done. Or it is tempting to create "new better-than-school-after-school" programs out of school that substitute for the poorly functioning school systems.

In other situations, out of school time is seen as time to provide special attention to youth who are having troubles, to subject areas that need special individualized attention not available in a typical school day. In still others, out of school programs are designed as programs for kids to attend while their parents are still at work. Often they are designed to substitute for families that are dysfunctional, or to provide help in supporting youth when parents are inexperienced in the school culture or in the dominant language community.

Standard out of school programs are oriented to "youth development", providing students with success experiences and a context for healthy activities which can launch them into success in school. Some are "academic", many being extensions of school days or homework assistance for these days.

Some out of school programs provide youth with enrichment experiences that are not available in school. Art museums provide an opportunity to experience great pieces of art, and interactions with well trained docents. Science museums provide hands on experiences with scientific phenomena, and in depth understanding of important scientific ideas.

Some out of school activities are completely unattached to schools. Others are highly integrated, and often function in school buildings “after hours”.

In sum, there are a grab bag of sponsored out of school activities available to youth, each of which uses this time to address a particular opportunity or problem. Some of the experiences youth have in these out of school contexts are life transforming. Some are the bit of difference that makes success in other venues obtainable.

So ultimately, in the abstract, will it some day be the case that out of school activities for youth substitute for in school activities? Will the out of school become the center of most youth’s lives, and schools become secondary? Will digital technologies, for example, make it possible for youth to learn as well out of classrooms as in them, if not better? Is it like a donut, where everything turns inside out and the “in school” moves from the center of the ring, and out of school times becomes the new central element?

There are a lot of issues to think about in this area (not the least of which is advocacy of the importance of “free time” for youth!).

The most important issue though, I think, is the acknowledgement of the social contract which public schools have with youth. They have taken the responsibility, for better and worse, to take responsibility for all youth --- not just the most naturally talented or the wealthiest --- to gain important academic skills that are judged to be important for success in (and success of) the culture. It is often the case that one should disagree with what these academic skills should be, or whether youth are being given a good chance to succeed, and that these standards and methods are changed and improved.

However, the central definition of a school is its social contract. Out of school programs don’t have these. Museums don’t. Youth development programs don’t. Other organizations can just do small things (though they may be critically important); they don’t take on the responsibility for cultural mastery of each and every child. Acknowledging for the moment that it is not a great thing to have a social contract that schools don’t keep, the idea of such a contract is revolutionary. It is magnificent. It is impressive.

So why not start from this point, rather than from all the other models of out of school which have been spontaneously developing in recent years? Why not build a set of services and facilities around schools that do the things that they have contracted for and are not able to deliver? And why not build alliances around organizations who create these complementary activities, and charge schools with the responsibility to establish and maintain alliances? Manufacturing entities establish alliances with parts manufacturers, product producers have alliances with retail outlets, architects have alliances with contractors and builders. Why is it that schools are set up “to go it alone”? Why can’t schools acknowledge their core competencies and then look to others to help them achieve competencies that are not at their core?

Are there areas, for example in science understanding or art appreciation or digital technologies, that schools are simply not very strong in for many structural reasons, even though all acknowledge these areas are important? Might there not be programs out of school that substitute

for entire areas of the curriculum in school? Or might there not be demonstration programs outside of schools that, in alliance with schools, develop new kinds of innovative programs that can be then imported into schools when they are established?

If one begins to think of alliances within the learning ecology of youth which benefit them, and which explicitly address the equity issues which are at the core of the social contracts which the schools have made with the society, then one might stand a chance at making important changes in schools which schools by themselves are unable to accomplish.

If we continue to think of added window dressings on youth's days, that are not sustainable, that are not integrated into the general goals of the culture and not supported by the talents of the culture, then nothing very much important will happen with out of school opportunities. Youth will take more lessons. There will be less time to daydream. Overzealous parents will take control of out of school time just as they have school time. Programs will come and go.

Yet if we think about alliances, we can well strengthen the whole of a child's day. The good and bad thing about schools is their conservatism and focus on the overwhelming demands on them. The good and bad things about out of school time is that it is flexible to organize and typically comes with few specific demands. The challenge becomes to think of combinations of these that make sense, and that are sustainable. One can't simply give up the social contract and do neat things I don't think. The question is how to do "neat things" that are socially valuable and widely available within the landscape of youth's every day lives, in and out of school.

Challenges and Opportunities

1. Incubators

One important activity to sustain in "out of school" is a set of programs that are designed to be eventually moved to schools. Design programs, digital technology training programs, scientific literacy involvements --- all of these can be put in place outside of schools. These incubator sites can then be available to show people in the schools and the community just what is possible. Programs can then be moved into schools. Or facilities can be established to provide more generalized out of school experiences to all school youth.

2. Partners

Schools are remarkably uncollaborative entities. They are fundamentally organized with an inward look rather than a glance outside for collaborators. There are obviously exceptions to this. Individuals in organizational behavior fields surely know something about this. It would be a challenge to identify the fundamental features of collaborative organizations and then work with schools to develop structures that allow them to collaborate.

3. Language Community

There is not a fluid language to talk about out of school and school issues. Clearly it is not just "time of day". It is also not academics vs. youth development, or formal learning methods and

informal methods that distinguish the places that youth find themselves in these different times of the day. We need to establish some clear ways of discussing these issues.

4. Digital Media

Let's just pretend that the most substantial resource for learning academic subjects happens to be electronic, and that the world's knowledge is available most effectively within a digital domain. Then let's pretend that the institutions that are responsible for the education of the youth are not connected into any of these electronic resources. Further, let's pretend that some school children are actually able to connect with these digital resources, with a wide range of generative and collaborative technologies, but only out of school.

What if all this happened?

Or, less facetiously, given that this does oddly seem to be happening at a very large scale, what is to be done? How does this science fiction story yield some momentum for youth to learn about both fiction and science, but independently?

It is rather a crazy-making situation we find ourselves in. I look to others for some great ideas about how to consider out of school and in school time in complementary manners, building and engaging whatever tools/materials we can think of to create a new landscape of possibilities.

5. CORAL

The James Irvine Foundation has established an initiative to investigate how out of school programs can encourage academic learning. The title of this initiative is CORAL – Communities Organizing Resources to Advance Learning. (You can download a description of this initiative from http://www.irvine.org/publications/by_topic/education.shtml). Its focus is on combining the different resources in a community --- its libraries, museums, schools, YMCAs, Boys and Girls Clubs -- - to provide youth with opportunities. This initiative, for which I consulted, has more than five years recent experience in establishing and observing academic afterschool programs in underserved areas.

6. CILS

The Exploratorium has established the Center for Informal Learning and Schools, a five year program sponsored by the National Science Foundation which is a collaboration of the Exploratorium, UC Santa Cruz and King's College in London (<http://www.exploratorium.edu/cils/>). It's goal is to investigate the interaction of informal learning methods, science and mathematics learning, informal science institutions and schools.



Comments Encouraged
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