EXPLORING THE FUTURE OF LEARNING

2002 Final Report

Prepared by
Advanced Network and Service, Inc.

www.futureoflearning.org

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About Advanced Network and Services:

Advanced Network and Services, Inc. was formed in 1990 as a nonprofit corporation dedicated to advancing education by accelerating the use of computer and networking technology. The organization has been instrumental in the development of both the current Internet and Internet2. In 1995, Advanced Network and Services created the ThinkQuest Internet Challenge, one of the most successful and longest-running, Internet enhanced, student-centered, project based learning initiatives in the world.

Exploring the Future of Learning is a three-to-seven year initiative, fostering conversations, projects and activities examining the powerful interactions among technology, educational systems, teachers, parents and students in the future of learning. EFL is designed to coalesce the broad educational leadership community around critical issues, leading to individual and collaborative actions that advance educational practice.

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INTRODUCTION

Technology has had a profound impact on every aspect of life today, changing the ways we work, socialize, conduct business, protect our health, communicate, inform and entertain ourselves. The information revolution has also changed the learning needs of students, while providing new capabilities to meet these needs. These increased learning demands have begun to make an impact on the curricular, learning and performance demands on schools, teachers and students.

Ironically, the very technologies that could change the basic fabric of teaching and learning are creating their own demands on teachers and school systems, as educators struggle to harness the power of these new tools, computers with Internet access, now found in every school and nearly all classrooms. Today's educators are struggling to learn to use the technology while also running hard to meet the increasing demands of curriculum, assessment and accountability. This is indeed a "double whammy" -- the demands of learning to use the technology are fully felt but the "productivity increases" that the technologies promise have, as yet, been little realized.

The impacts of these multiple, increasing demands on K-12 learning are everywhere evident: in the confusion and exhaustion of teachers, in pervasive public dissatisfaction with education and the resultant finger pointing, and in the polarization and politicization of reforms that never get past the starting gate.

Yet the news is not all bad: if new technologies and the resultant information revolution are indeed major contributors to the increased demands on education, they are also a reasonable place to look for solutions. These are, after all, powerful tools, powerful

enough to change our world. But we have yet to articulate how they can best be deployed for more effective teaching and deeper learning.

What has become clear is that using these tools most effectively will require new approaches to the ways we think about learning. What is also clear is that the presence of the first wave of technology (computers) or the second wave (Internet access) does not, in itself, change long-established habits of educational practice.

Adding to the urgency of the need to come to grips with these issues is the reality that, today, there is a third wave of technological advances on the horizon. With the emergence of Internet2, high quality 3-D graphics and animation, interactive tele-immersive virtual environments, intelligent agents and new wireless technologies offering relatively cheap and powerful anywhere, anytime connectivity, it is even more important for educators and educational leaders to step back and ask the right, albeit difficult, questions about the future of learning.

The goal of the Exploring the Future of Learning (EFL) event was to stimulate serious discussion about these possible futures of learning and how we could envision and create the future we want. We jump-started this conversation by bringing together educational technology leaders, teachers, students, developers, administrators, policymakers and futurists for a weekend of exploration and reflection about learning in an age of rapid technological and social change. Sponsored by Advanced Network & Services (Advanced), a nonprofit organization dedicated to advancing education, the University of Washington (UW), and the Institute for the Advancement of Emerging Technologies in Education (IAETE) at AEL, the conference was held July 20-21, 2002, on the UW

campus in Seattle, Washington. This conference also launched the on-going EFL Initiative.

The goal of the event was to bring participants together in a stimulating environment where they could explore emerging technologies and learning applications. Additionally, we hoped to provide an opportunity to look and think beyond this month and this year and give them the opportunity to envision and discuss how future learning environments and experiences could be designed, created and sustained. Perhaps the most radical surprise for many was the active involvement of students in all aspects of the conference. Beginning with the launch of the ThinkQuest Internet Challenge in 1996, Advanced has been responsible for creating over two dozen ThinkQuest programs in more than 100 countries, empowering students to design educational content that uses the Internet as an engine for resources, interaction, and active learning activities.

Students have always been at the leading edge of creativity in ThinkQuest programs, so it is not surprising that students were equal participants in all aspects of EFL. Almost 100 ThinkQuest student alumni from around the world participated in EFL. Other student volunteers provided most of the computer setup and technical support for the event. A group of middle and high school students were trained on site to serve as student journalists. They interviewed pavilion leaders and other participants, videotaped the event in progress, and recorded the activity live on the EFL Conference website they managed and maintained. To visit this website, read their reports, and see the conference through their still and video camera lenses, go to www.futureoflearning.org/efl/sj.

The format of EFL was unique: for the first day and a half, participants immersed themselves in the "Exploratory", a hands-on technology and learning laboratory where forty interactive projects were grouped in ten pavilions around themes of curriculum, leadership, and technology. The Exploratory was designed to actively engage participants in hands on activities, so that they might better understand promising emerging technologies and learning applications.

At noon on the second day, the Exploratory closed and all attendees were invited to participate in small symposium workshops led by a distinguished group of "intellectual rapporteurs" who guided spirited discussions on significant questions emerging from the event. These discussions encouraged participants to envision both the possibilities of future learning environments enhanced by new technologies and new understandings of learning as well as the challenges to achieving these visions. These collective visions and reflections formed the basis for the closing plenary session on Sunday afternoon, led by Esther Dyson.

A highlight of the closing plenary was the student panel that provided a summary of a student workshop, held the previous evening, led by scientist, artist and author Jaron Lanier, and educational technologist Bruce Lincoln. The students on this panel challenged the commercial sector to retarget their media and technological products to meet the concerns of today's young people and called upon educators to find ways to capture the "mindshare" of students' attention from today and tomorrow's high production value/low content value media barrage. The plenary session concluded with a final challenge for the future, presented by Terry Rogers, CEO of Advanced Network and

Services. That challenge, built on the conversations growing out of the EFL experience, stated:

> *By the year 2010 children will have access to a working and cost-effective learning environment adapted to their individual learning aptitudes and goals, which is as compelling as other parts of their environment, which helps them achieve their full potential in the world, and which is capable of being adapted and used worldwide.*

This report provides a look into the future of learning from the perspective of a variety of presenters and participants at the EFL event, including students, pavilion leaders, intellectual rapporteurs, and attendees. For a full list of pavilions, pavilion leaders and intellectual rapporteurs, see Appendix 1.

EXPLORING THE FUTURE OF LEARNING 2002

SETTING THE SCENE

Ed Lazowska, a nationally renowned leader in academia and holder of the Bill & Melinda Gate Chair in Computer Science at University of Washington, welcomed participants to the EFL conference on behalf of UW. In his opening remarks, he set the tone for the conference:

> *Our goal this weekend is to envision what teaching and learning might be, and to imagine the sorts of programs that might help achieve this vision. Despite all the computing equipment you see in front of you, it's not about technology. It's about teaching and learning. But technology will play a key role.*
>
> *If you've been involved in teaching and learning for any period of time, this should immediately make you really nervous. Educational technology isn't new:*
>
> - *We went from slates to blackboards to whiteboards*
> - *We invented film, and microfilm*
> - *There was radio, then television*
> - *Now there are computers*
>
> *At every step along the way, people claimed that they had found the answer to transforming education:*
>
> - *1922, Thomas Edison said: "I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks."*
> - *1932, Benjamin Darrow said: "Radio may come as a vibrant and challenging textbook of the air."*
> - *1954, The Audio-Visual Reader, Kinder and McClusky, eds. "Radio with its eyes open... When the eye and the ear have been remarried in television then we shall indeed be challenged to open wide the school door. There will be no 'blindness gap' to be bridged."*

- *1984, MIT computer scientist Seymour Papert stated: "There won't be schools in the future. I think the computer will blow up the school."*

Educational technology has a long track record of dismal failure, or at least of falling far short of the claims made for it. So, why might it be different this time around?

- *Increased knowledge of how individuals learn*
- *Technology can accommodate multiple learning styles*
- *There are early examples of appropriate educational technology to inspire us*
- *(Today's technologies are) interactive, adaptive, flexible*
- *Networks and the Web connect us*
- *(Today's technologies) foster exploration, interaction, community*
- *Moore's Law is finally paying off (Something that matters is doubling every 18 months)*
- *There's a clear recognition that teaching and learning must be the focus, not technology*
- *"Digital kids" are ready!*

The challenge:

- *Couple advances in the learning sciences to advances in educational technology*
- *Couple these to educational practice*
- *Approach the ideal: A teacher for every learner*
- *Transition students from being passive, often uninterested, consumers of information to active participants in the process of discovery ("a lecture is a way to get material from the teacher's notes to the student's notes without having it pass through either brain")*
- *Give students opportunities to form and work in communities of interest, communities that cut across boundaries of age, culture, and geography*
- *Work with teachers and develop tools that will allow all children to learn; that identify the unique talents (and needs) of each individual; and that help develop the talents of these individuals so that they will be prepared and equipped for a lifetime of learning*

We're here to think about the future. Predicting the future is risky business, particularly where technology is concerned:

- *1943, Thomas J. Watson (projected): "I think there is a world market for maybe five computers"*
- *1977, Ken Olson (scoffed): "There is no reason anyone would want a computer in their home"*
- *1981, Bill Gates (disclaimed): "640K ought to be enough for anybody"*

As educators, however, our job is to prepare students for a future that we can only dimly imagine. What will this future look like? How can we best help our students not only to live in this unknown future but, most importantly, to create it?

Over the next few days, we'll have opportunities to consider this future. We have all seen some remarkable things happen when talented students and teachers employ these tools; that's why we're here! This is your chance to "kick the tires" and imagine the future of learning.

REFLECTING ON EFL: PERSPECTIVES OF PAVILION LEADERS AND RAPPORTEURS

The EFL Exploratory was comprised of 40 demonstration projects divided among 10 thematic Pavilions. Despite their varied emphases, the Pavilions were linked by common threads. Taken together, these ten pavilions and the projects featured all gave participants a feel for what it is like to have tools that, (a) enhance communication between and among learners, experts and teachers, (b) empower learners, and (c) change teaching and the roles of teachers. These concepts resonated over and over in the reports written by student journalists at the event and in the reflection pieces written by the pavilion leaders and the rapporteurs.

ENHANCING COMMUNICATION AND CREATING COMMUNITY

Margaret Riel, who has long been a leader in using technologies to create communities of learners, raised this theme in her analysis of the projects in her emerging technologies pavilion:

> *What was common about all of the exhibits that made up the emerging technologies pavilion was the central role of communication and collaboration in the design and use of all of the technology. There were no tools that were designed to be used by a person working alone.*

She describes several of these. For example:

> *Bonnie DeVarco and Margaret Corbit talk about their work as developing community among schools, universities, centers and organizations that seek to explore learning in active worlds, worlds where users see themselves and others in social spaces they can help shape. The Active Worlds Educational Universe includes projects that have evolved from this collaboration to provide rich educational contexts including these designed by Virtual Learning in 3D (Vlearn3d.org). These cross-disciplinary communities have designed rich simulations including genetics labs where students can experiment with crossing different forms of plants and watch the results of successive generations in minutes rather then weeks, months or years.*
>
> *Chris Dede and Kevin Ruess with funding from the National Science Foundation demonstrated another use of these graphical multi-user virtual environments. Using digitized museum resources, they created a participatory learning and problem solving activity that take place in an immersive world of the past (late 19th Century River City)… (*where, as teams, they have*) a mission—to find the source of the problem* (increasing death rates*) and restore balance and health to this small community. In this project, they explore the pedagogical strategies that foster strong learning outcomes across a wide range of individual student characteristics (e.g., prior experience with computers, knowledge about and interest in science, gender, ethnicity, linguistic proficiency in English). They are finding that these types of environments are very motivating, and are rich vehicles for collaborative learning.*
>
> *While these worlds pull one into the computer, increasingly our interactions will blend interactions online with interactions on the ground with small groups of people. The new technology of Magic books can make reading a social interactive experience. These books have text and pictures but you can not only read them in a conventional way but with the aid of special computer glasses, the "reader" can see a small theatre taking place over the pages of the book. With a*

click of a button, the reader's perspective can change as they shrink down in size and enter the world as one of the characters fully immersed in a virtual world with other "readers." Together they influence the outcome of the story.

STUDENTS' APPETITE FOR CONNECTIVITY

Tammy McGraw, Executive Director of the Institute for the Advancement of Emerging Technologies in Education, IAETE at AEL, wrote of the importance of what she called students' "appetite for being connected":

> *I was drawn less to the technologies than to the young people who were so integral to this event. Meeting them evoked my recent teaching experience and provoked thoughts about the impacts of technologies that have become fundamental in students' lives.*
>
> *Today, students seem very different from the students I taught little more than five years ago. I now believe that, to build a vision for the future of learning, we must first understand today's tech-savvy students… Students no longer simply consume media; they manipulate, adapt, generate, and disseminate media. They want to experience media in ways that are new, meaningful, and relevant to them. They are beginning already to adapt media to their personal learning styles and preferences. In the future, students will routinely be engaged in shaping their learning experiences.*
>
> *Learning and the tools of daily life will become increasingly entwined. Clearly, the students I met at EFL have an appetite for being connected. Cell phones, PDAs, and a combination of the two were used with amazing fluency. I asked one student for his Website. He didn't reach for a pen and paper, or even for a business card; (yes, some of these students have business cards.) Instead, he asked if I would mind if he simply beamed the information from his PDA to mine.*
>
> *Wireless communication and broadband access, coupled with the interoperability of various devices, will provide unprecedented opportunities for students whose standard gear now includes cell phones, PDAs, laptops, digital cameras, and video cameras. I believe this interconnectivity will support a distributed-learning model that will take formal and informal teaching and learning beyond the constraints of space, time, and media.*

The students at EFL demonstrated this appetite for connectivity. For them, technology's most important function is as a tool for cross-cultural connections. Each of the three

leaders of the student pavilion emphasized the importance of using technologies to support cross-cultural understanding. As participants in the ThinkQuest Internet Challenge, they had shared their projects with students around the globe. As finalists, they got to meet student designers in person. Once they experienced the power of a cross-cultural community, there was no turning back for them. Not surprisingly, they designed their student leadership pavilion as a global hub, a lively place where participants speaking languages from all over the world noted their home base with colored stickers on a fast filling world map, and created personal postcards with their digitized portraits, passports for recording observations and travel brochures in which they described what items they would need to pack for their trip to the future of learning. They used videoconferencing tools to start the visitors to their pavilion on their trip into the future of learning.

Tobias Kohler, a finalist from Germany, described how ThinkQuest projects have given students like him the opportunity to acquire what he calls "intercultural competence", which he describes as "one of the most important skills in a global world economy". By communicating with one another, they get to know their teammates' life styles, cultures, traditions and values. This experience, enhanced by his participation in EFL, led him to say:

> *My very own vision of the future of learning involves a strong emphasis on intercultural collaboration with the help of the Internet. My experience as a ThinkQuest finalist has shown that intercultural contacts, open-mindedness, curiosity and the readiness for life-long learning constitute central prerequisites of a future information worker in a networked economy as well as a free and self-determined citizen in an information society.*

His co-leader Emily Boyd, from Australia, put it this way:

In the future, it will be essential that students have access to the Internet, so that they may communicate with other students around the world. While collaborating with students from the same school may be beneficial, it is much more valuable to work with people from different countries and cultures.

Laura Eckstein, born and raised in a small town in Minnesota, had traveled no further than Chicago before she got involved in ThinkQuest. She now says that she "has the world in my bedroom." What does she envision for the future of learning? "Teaching and learning without boundaries."

WILL LOCAL VOICES BE HEARD?

Projects in the Collaboration and Communications Tools Pavilion demonstrated the ways "teaching and learning without boundaries" could happen. The Pavilion leader, Stan Silverman, a pioneer in the field of distance learning, sees communications technologies as a vehicle for local empowerment. Here is what he said about this view of the future:

The major communications highways have traditionally be driven by top down and therefore exclusionary applications and have been driven by the need to meet mass audiences and generate return on investment. It is essential that we do not repeat the sins of the past and allow the new highways to become the sole property of mass content providers. We need to insure that every member of the learning community has the ability to select content, provide channels of dissemination and create the context and capabilities for natural needs based collaborations.

As we roll out new applications and technological capabilities we must keep in mind the need to address the issues of local voice and local empowerment. The issue of the digital divide goes well beyond the counting the number of brown, black or white fingers that touch keyboards but to insuring that all educational sites can be both the receiver of high quality interactive content and the creator of content and applications specific to the needs of their constituent groups.

EMPOWERING LEARNERS: DO WE DARE?

But empowerment implies permission, and permission to change is perhaps the ultimate challenge for taking advantage of the power of these technologies. Carolyn Staudt, a teacher and curriculum designer at the Concord Consortium, believes that modeling tools – like *See Math* and others showcased at the Math and Science Pavilion – allow educators to do something they have long sought. These tools pinpoint the intellectual stumbling blocks that prohibit student understanding and, based on a clearer understanding of them, diagnose the problems and create learning opportunities to help them overcome them. Here is how Carolyn put it:

> *In the past, many existing school technology projects were used to reward short-term recall. The new modeling software has the potential to be used as a diagnostic tool providing analysis without testing. This analysis is embedded into the software and promotes activities that search out conceptual understanding by archiving student conceptions and structuring branching to help students resolve their misconceptions.*

However, the potential may be lost due to current political pressures facing educators:

> *With the current drive for testing, many of the schools are faced with timing restrictions due to the necessity to cover all of the standards for testing. This is in direct opposition to in-depth conceptual coverage with modeling technology.*

She also notes how important it is that these tools work for teachers, in ways that will truly help teachers. For now, teachers are more comfortable with these tools as "extras", as the school culture may not be ready for their going mainstream.

> *Since the use of modeling technology is a shift in paradigm for most teachers, modeling projects need to be user friendly with transparent scaffolding and rubrics embedded. Many of the projects were presented as enrichments to existing instruction, which challenged the students and provided rewards for success. This type of technology-assisted mentoring allows the teacher to reflect on the student models immediately and reflect on their practices. This was especially evident by the interest shown by teachers and parents while openly discussing video case studies presented by Seeing Math.*

.... As the amount of information overload increases, teachers need new tools to integrate the different topics. How do we effectively use the technology to take the advantage? Many of the modeling projects presented at Exploring the Future of Learning focused on the collaborative software that shared ideas while tracking individual needs of the students.

Is this the nature of the school culture? To incorporate this type of modeling technology into the present school culture, the teachers must effectively use it. How do we control the distribution of the technology? The WISE database is a great example of presenting the technology, showcasing projects, and targeting design principles that link multiple competing curricula so that teachers can network without borders. By presenting different perspectives from different locations across the country, teachers can pick the best technology for their needs. This type of database will help in scalability and accountability of the modeling projects.

NEW WAYS OF KNOWING

Michael Jay, a Rapporteur who has been involved in education technology for over twenty years in K-12, higher education and corporate roles including development of the first set of Technology in the Curriculum (TIC) materials for the State of California and contributions to Apple's Classroom of Tomorrow (ACOT) research, described how he was particularly taken with technologies at EFL that represent what he calls a "third level of implementation". Whereas the first level "simply replicates the non-technical experience, the second amplifies that experience solution," but the third "opens a door for the learner to make sense of the world in ways they may not have been able to do without that technology." He found that "several of the most intriguing technologies shared at EFL fell into this third paradigm", giving as an example the echolocation demonstrated in the music pavilion:

One might wonder how computing interfaces would be different if their creators had used echolocation as their primary means of interacting with their world. Humans rely on sight and touch for most of their navigational and descriptive purposes where as a moth might describe the world by its smell/taste and a bat or porpoise by its sound. Chad Kirby and Richard Karpen's Interactive Sound Tent sent me into an auditory tizzy. Although I consider myself aurally literate, interpreting the feedback provided by speakers situated around the tent from the modified input of two microphones hanging in the same tent where I was standing proved challenging. My first visit whet my appetite and I returned 3 more times during the meeting each time working to train my mind to even begin to create a

mental image of the sound I was hearing… even the word image has a visual connotation! Imagine how much richer the world would seem if we could paint a picture that was more than just visual. The Interactive Sound Tent spawned for me a whole new way of thinking about representation.

He concluded with this musing:

Imagine a world where learners are equally versed in making sense of the world using all their senses and can enter worlds where they can explore, engage in sense making with information beyond what they can initially see, hear, or feel and then use that information to connect disparate information together to form new understandings and knowledge which they can in turn use to create new virtual or even real worlds. If this is the learning environment that is in store for us I can't wait!

THE OPTIMISM OF STUDENTS

In response to a question posed on EFL's discussion board after the conference, asking: "How can these technologies help students become better thinkers or better decision-makers?" Jane Chung, a student who had attended EFL said:

I truly believe that a revolutionary form of education will advance and thrive, allowing students to reach potentials that are truly incredible. This year I participated in the Imagine the Future project where we, a team of five students, brainstormed and presented a project where we were to imagine the future of learning through advanced digital technologies.

Our project used technologies such as haptics and tele-immersion to teach students in a more "whole-brained" manner. Virtual learning will help things be more available to students. For example, if you had a biology class, instead of memorizing laws and formulas and the experiments that they were derived from, students could have virtual access to the same type of organisms or chemicals and conduct experiments themselves.

Students will possibly be able to explore the rain forest and as they engage in their own experiments, will hopefully gain not only knowledge, but blossom with curiosity and appreciation for science itself. We believe that with this vision of future education, students will truly achieve their full potential. These advanced technologies are the bridges and the catalysts we need to revolutionize our methods of teaching and learning.

STUDENT EMPOWERMENT WITH HANDHELDS

Elliot Soloway, Professor at the University of Michigan and Cathie Norris, Professor at the University of North Texas, researchers who have long worked to create new technologies to support authentic learning activities, believe that:

> *The computing revolution that has already transformed manufacturing, science, accounting, and entertainment...is finally about to transform primary and secondary education. In five years, by 2007, the core technological infrastructure can be in place in schools to support education's transformation...with the emergence of low-cost (in the $100-$200) range handheld computing devices*.

When "each child will be equipped with their own, personal, handheld computer, for use all day in school, on the school bus, at home, etc., that is wirelessly-connected to the Internet"…this ubiquitous 1:1 computing will make learning in context a reality. Nevertheless, they realize that the computing and networking infrastructure are the "easy part"; the real challenge is creating software that is learner-centered, scaffolded to support each learner, and built around content that teachers value. They laid out three examples of this:

- ***Truly personal computing****: In the past the desktop has been central with handheld devices serving as peripherals. However, in the Full-Access Infrastructure, handhelds are primary while desktops/laptops/visualization stations become the peripherals. Operating systems need to be redesigned to accommodate this new order.*

- ***Task-oriented computing****: In the past, applications (e.g., a word processor, a simulation program) are the objects around with activities are organized. However, as learners use handhelds for all their learning activities, tasks become central, with students needing between 3-6 applications to complete a task (e.g., produce a report on an inventor, that includes information gleaned from the Internet, text and animations, mathematical objects and videos.) Students want to produce their report, not learn a word processor, a graphics editor, a video editor, etc. The current way of producing separate applications does not support task-oriented learning and doing.*

- ***Learner-centered computing:*** *In the past, all learners needed to use the same application interface, regardless of their learning needs, styles, developmental issues and preferences. However, the promise of software is its customizability and thus its ability to finally address the diversity that is the hallmark of learners and learning.*

And, if the software challenges weren't enough, we need to remember this: schools don't want technology, schools want curriculum. The full-access computing infrastructure, powered by learner-centered software, will transform teaching and learning if and only if teacher-accessible curriculum is available along with professional development to prepare teachers and assessments that are appropriate to what the children are learning using the full-access computing infrastructure.

NEW WAYS OF TEACHING MEAN TEACHERS' ROLES MUST CHANGE

Even the Classroom of the Future – portrayed so graphically in the Learning Space demonstration – still has a teacher. But that teacher may not be at the front of the class, or even, as is the case of the Virtual High School demonstration, in the classroom at all. The teacher's location may seem a small point, but in fact it is reflective of a new role – no longer at the head of the class, but ever in the heart of the class. Throughout EFL, student learning empowerment had as its flip side the idea of teachers as the "lead learner" guiding the learning within that learning community. ThinkQuest student leader Tobias Kohler put it this way:

In our discussions about a future scenario of the classroom, there were several remarkable points made by the students. I want to mention the…most important ones:

Firstly, the changing role of teachers. The students agreed that in eight to ten years from now, learning would have a more self-paced character. That would make it necessary that a teacher, being also an expert in learning technology, looks after her students more individually. Teaching "in front of the class" might be replaced by individual, even remote coaching. Moreover, a future teacher is expected to be a learner at the same time. One cannot require kids and young adults to be life-long learners if one doesn't live the example and doesn't prepare them for a life in a knowledge economy.

CAPTURING THE "MINDSHARE OF YOUNG BRAINS"

When Jaron Lanier, lead scientist for the National Tele-Immersion Initiative and Bruce Lincoln, Sr. Educational Technologist, Columbia University and a multimedia designer/developer and community technology innovator, worked with the students in preparation for the plenary session that concluded EFL, a whole new perspective was created. Rather than ask students to "design the future of learning", they took another tack, asking them to think about the video games, popular songs, and movie/TV productions that "fight for pieces of young American brains". Lanier and Lincoln suggest that the reflections of students suggest ways educators could compete with marketers, advertisers, and popular culture in capturing the "mindset" of young people with things they truly care about but are excluded from the dominant vehicles of informal learning today:

> *For each of these three categories I asked the kids to identify themes or ideas that seemed to be missing from all commercial offerings they had been exposed to, focusing on the most glaring omissions, gaps that once they were noticed seemed bizarre. Here are the results:*
>
> *In video games:*
>
> *Kids love the "Sim-" series games, like Sim-city and The Sims, but found it odd that the things they care about most are not addressed in such games. These included:*
>
> - *"Sim-etiquette" This idea recurred again and again in the small groups that were assembled in isolation from one another. Teens and young adults are obsessed with figuring out how to relate to other humans, and that huge topic is addressed by movies and songs now, but not by digital media… If that is so, could a sim-etiquette game be the bearer of educational content beyond etiquette? I think the answer is plainly "yes", and the reason for that will become apparent as we survey some of the other results.*
>
> - *Another category of longed-for teaching simulations was "Sim-fix-the-real-world" games. One channel of media that gets through to kids and young adults is the news, and of course it is frequently bad news. Again and again*

the groups brought up the notion of using sim-style games to explore how to improve the world's problems. Some of the main subjects were third world economic development, peace negotiations, and ecological resource management. During the presentation at the plenary session, an Egyptian student suggested a Mid-east peace negotiation sim-game. I regret having lost track of that student's name and would like to follow up on this idea. There are widespread online war games being played by both Arab and Israeli youth at this time, and starting an online peace game would be a relatively inexpensive and potentially beneficial activity for the computer educational community.

- *There were also repeatedly expressed desires for sim-games that would help young people prepare for life. Some of the ideas that seemed to have general resonance were sim-health (for lifestyle decisions over a lifetime), sim-college, sim-cooking, sim-hospital, sim-car repair, and so on. The students who participated in the exercise generally reported anxieties about whether they would be able to handle challenges related to all of these topics, and felt that the video game experience was one of their primary means of exploring emerging aspects of their personalities. If only video games would directly address their greatest anxieties!*

Here once again is an opening for educators. There have been titles along these lines over the years, but it seems there is still a vast unmet potential. This is the kind of content that commercial developers are unlikely to do well, yet either educators or kids (working perhaps in a ThinkQuest contest context) might be able to do very well.

- *In part to tease the students in Seattle, I suggested an ultimately self-referential sort of sim-game, which would be sim-parent. In this game, a kid would have to become his or her own parent. The kids found the idea shocking and unpalatable, of course.*

- *There was one more category of frequently-wished-for-but-unavailable game that I believe presents educators with a special opportunity. This is a game in which the player takes on the identity of some unusual agent in reality, in an almost surreal way. One example was to become a chair, to imagine what it's like to have all sorts of different people sit on you, and to be able to cause some of them to become itchy and so forth. Another example was to become a fly.*

I've personally held a belief for many years that identity shifting is central to the appeal of computers to kids. The computer is the first playground in which the ongoing states of imaginative scenarios are not merely held in the brain, as with old-fashioned make-believe, but are present in the objective world to be shared by others. The computer provides the first sort of reality that is both objectively shared (like physical reality) and yet also has a good measure of the fluidity of a dream.

Kids respond to this aspect of computers because they are young enough to remember how frustrating is was to have to give up fantasy and accept the limitation of reality… Here, once again, is an opening for educators. By being able to address the desire for surreal experimentation with identity, educators can create striking materials that can compete effectively with fancier and flashier commercial offerings. The need to cross-market between media ties the commercial designers down into a certain kind of conservative mindset that gives us a potential advantage.

Some identities I think kids would like to take on: Becoming a photon, a water molecule, an endangered species, a piston, dollar bill in an economy, and so on. The notion of using identity as a way of teaching a wide range of subjects has been explored in some cases, but it seems there is a huge potential for further development.

I also asked the kids about the other two media categories, songs and movies/TV, because I wanted to get a feeling for what the media conglomerates are missing in the non-interactive realm, just in case it might suggest some strategies for non-interactive educational materials or strategies. Here are those results:

- *As for songs, the kids were almost outraged by the degree to which songs seemed to be about the experiences of previous generations, rather than their own. For instance, they pointed out there's never been a song on the radio about internet dating, even though most songs are about dating. Internet dating is their primary means of seeking romantic partners. I'm not suggesting that educators run a dating service, certainly (though high schools have had proms for generations, which served a similar function). What I am suggesting is that educators actually can compete for mindspace by being more aware of kids than commercial concerns. Despite the many millions of dollars spent by the entertainment conglomerates on market research, they still are forced by their own prejudices and momentum to be blind to many of the ways that kids are changing.*

- *Some of the other experiences that dominated the lives of kids that seemed to them to be oddly absent from their media environment were: eating disorders, tension about terrorism and increased security precautions, furious curiosity about how much medicine will change as they become older, and specifically digital topics, such as the frustration of being a teenager limited to a dial up analog modem for internet access.*

In the area of movies and TV, the perceived holes were much more specific to technology. There was universal condemnation of movies and TV shows for inaccurate portrayals of everything about computers. Some of the specific complaints:

1) *Kids are often portrayed hacking into something, but almost never as programming something positive and creative on a computer.*

2) *Technologically literate kids are still portrayed as having inferior sexually attractiveness and this REALLY offended the kids.*

3) *School computers are conspicuously absent from school-based dramas like "Buffy the Vampire Slayer".*

4) *The full range of emotions associated with the use of computers is not ever dramatized. The kids were positively amazed that fantasies of smashing up computers were not widely portrayed.*

Once again, this data might suggest a potential for educators to compete for mindspace in kids by knowing them better and reflecting them more honestly.

While I construed the exercise in terms of conflict, of course we also seek collaboration and contributions from industry. However the relationship is conceived, if education is to improve, and specifically if the use of digital technology is to be a part of that improvement, there will have to be a realignment of the battle for mindshare within the brains of kids.

One way the future could be shaped is that kids will find the flash in consumer electronics and Hollywood productions, but will expect to find truth and meaning in "last year's computer" and content that comes out of the educational world.

Lanier, Lincoln and the students challenged us to rethink how educators can grab the "mindshare of the brains of kids". Milton Chen, Executive Director of the George Lucas Educational Foundation (GLEF), comes from a place that knows how to capture "mindshare" of young people. Nonetheless, he and his colleagues at GLEF are thinking about more than video and games, and moving the discussion to the physical design of schools and how they affect the designs for learning. In his role as an intellectual rapporteur, Chen described how his discussion group:

…worked on the design of a new school facility, sketched by New Mexico architecture professor Anne Taylor… It presented a new and bold vision of the classroom of the future, where the classroom felt more like a good museum or science center and where students were not promoted based on grades, but "moved with mastery," enabling students to work in multiage groupings. The classroom "learning environment" would be modeled on set design for movies, with backdrops and technology on wheels, enabling activity centers to be easily reconfigured.

Activity centers could include a rainforest study center, a space travel center, an aquaculture center, a multimedia literacy and production center, a living cultural museum, a kitchen for making cultural dishes, and an art/drama/music center. There would also be an outdoor garden, tree farm, and animal farm.

Chen points out the reality that, over the next five years, school construction and renovation, estimated to approach $100 billion over the next five years, provides a not-to-be lost opportunity to design what professor Taylor calls "buildings that teach." Chen suggests:

Technology presents new opportunities to reconsider not only the "bricks and mortar" of schools' physical environments, but how virtual "clicks and mortar" can join schools to their larger communities and the world-wide web of learning. Laptops and handheld devices, together with wireless networks, are enabling a new, portable style of computing, liberating students and teachers from their desks and enabling them to access and record information from locations on campus and in the community. And, as students increasingly inhabit a digital world, their closer contact with nature becomes even more important.

BEYOND THE "FLASH AND WOW"

Many participants noted the "flash and wow" of these technologies, but wondered where they really are taking us. Writing for *Multimedia Magazine* about how he and other students had struggled with a design for their Imaging the Future of Learning project that would be showcased at EFL, Raymond Liu, a graduating senior from Moanalua High School in Hawaii wrote:

The EFL conference showcased all the emerging technologies that could be used in the future of education, basically reflecting our entire project. For several months we learned and dreamt about telemersion, virtual reality, and other new tech, and when we were selected to present our ideas to the conference and actually see the tech in action—well, it was the perfect culmination for our project.

We immersed ourselves in the technology, and by actually testing and experimenting with it, were able to make a better assessment of the technology as a force in education. And, to be frank, we were somewhat disappointed with the

technologies at the EFL conference. Though it had just about everything we had researched plus more, the applications were not as well developed as we had hoped. We tried out the tech available, and though the ideas behind the tech were cool, we felt the technologies themselves are not practical enough to be used yet. Our ideas were based on fully functional systems capable of keeping up with a student's education, and even though we expected the technology to be under development, we didn't expect it to be as underdeveloped as it was at the conference. "That's the tech? Looks better on the website." "How is that supposed to be useful?" "If only it was less distorted." "I thought it would be faster," These are a sampling of our thoughts.

Tom Carroll, Executive Director of the National Commission on Teaching and America's Future and former director of the Preparing Tomorrow's Teachers to Use Technology (PT3) Program, was an early leader of the E-Rate initiative that brought billions of dollars of technology hardware and infrastructure into K-12 schools. He suggested that, for whatever reasons, educational technology may be experiencing a hiatus in implementation, a time we might use productively to define how advanced technologies can be best deployed to address unmet learning needs, (which was the goal of the EFL conference).

He cited the value of the demonstration in the "New Roles for Teachers" pavilion in which participants in the Learning Space experience moved from a schoolroom of the past to the school of the future. Experiencing this offered a rich opportunity for participants to engage in a discussion that went beyond a particular product or program and focused instead on new roles, relationships, and activities that go on when teaching changes.

Speaking from considerable experience, Carroll described the current status quo in schools and addressed the dilemma inherent in putting technology at the forefront in discussions and programs focused on changing education:

> *A big issue here is that, despite all of our best efforts, the technology and applications are still up front and efforts to change the roles of teachers and students, along with need to change the learning environment are still too often subordinate. …The power happens when the teachers and students get hold of this stuff and redefine their roles so that they are able to accomplish new work.*

Carroll's emphasis on the active role of teachers and students in the process of enhancing learning was echoed by a number of participants. How this happens and whether these are appropriate roles for teachers or students are questions central to the future of learning.

THE POLICY CHALLENGES AHEAD

Those who came from policy backgrounds, like Tom Kalil, former Deputy Assistant to President Clinton for Technology and Economic Policy, and now Special Assistant to the Chancellor for Science and Technology at UC Berkeley, sees the issue of digital opportunity as one that legislators must grapple with head on. He described the need for sustained comprehensive investments if long-term change is to occur.

Kalil also described the need for investment in

> *…cutting edge content and applications that have the potential to significantly enhance education, training, and lifelong learning. Currently, federal government spending on educational research and development (R&D) is less than 0.1 percent of total expenditures on K-12 education. Federal investment in R&D in testbeds for digital libraries is also small and limited to a few programs at the National Science Foundation, the Library of Congress, and agencies such as the Institute for Museum and Library Services. There is also very little rigorous, third-party evaluation of educational technology that would help us create a cumulative understanding of what works and what doesn't.*

He also sees the "dismal market for educational software and content" as part of the problem, especially when current expenditures on educational software are at a rate of $10 per student, compared to the "tens of millions of dollars that are available to develop

massively multiplayer role-playing games — that can engage the average user for over four hours a day!"

Bob Tinker, who has been developing cutting edge technologies for math and science over the last three decades, agrees. But he is even more direct. Without a national commitment to funding for innovation in education, he believes we will be unable to "capture the mindshare" of America's youth. He asserts:

> *The major barrier to realizing the educational potential of information technologies is the lack of funding for developing and testing classroom-ready innovations. We appear to have decent funding for basic research, outstanding technology, and a huge system for moving innovations into schools. But the innovations themselves are a small fraction of what is possible. In particular, the commercial sector seems unable to support complex educational software applications; the market size and the return on investment are inadequate.*
>
> *What we see instead is a flood of small applications of limited educational value, certainly not the exciting kinds of applications that we know are possible, some of which were highlighted at the conference. Curricula that take advantage of the sophisticated software and networking potential could truly change education in fundamental ways, but we need new strategies for producing it. There is little funding and almost no realization that this is a need.*

But Elliot Soloway, who suggests, "we techies are ever the optimists", adds:

> *That's "what" has to happen. So, "how" will it happen? With textbook companies making record profits with dead-tree based products, with it taking ten years or more to transition research-based software into schools, with the United States' current focus on school accountability and student testing, one might not be sanguine that there is a realistic "how."*
>
> *But, indeed there are positive signs, (citing the Jeffords bill currently in Congress). With such large-scale, governmental support, the pipeline between research and practice, between ideas and their scaling and commercialization, can be streamlined and fast-laned. Just as manufacturing companies have learned to get along better with their supply-chain colleagues in order to further each's own self-interests, educational organizations such as higher-ed, textbook companies, student testing companies, technology companies, school districts and schools need to strengthen their relationships and see that working together will make everyone more effective*

Doris Redfield, Director of the AEL, Inc. Regional Laboratory, thoughtfully connected several of today's most important challenges in education. She summed it up this way:

> *Realizing the vision more universally requires commitment to the vision, a critical mass of humans to work on realizing the vision, and courageous decision-makers who make wise and informed decisions about schools, schooling, and educator preparation. It also requires commitment to support and conduct research that allows for replicable findings, dissemination, and transfer. Otherwise, technology will not "even" the playing field, it can make it more disparate.*

* * * * *

EPILOGUE – WHERE DO WE GO FROM HERE?

Dr. Terry W. Rogers, President and CEO of Advanced Network and Services, states:

> *Looking back on EFL in Seattle, we can clearly see several things. There is wonderful technology on the brink of commercial availability, but most of it is not ready for educational prime time. Trying to push it into schools will have, at best, mixed results. Waiting for someone else to adapt it to schools is fraught with difficulty. It is not obvious how best to utilize it. Above all it is clear that the future of learning is not just waiting out there for us to discover it.*
>
> *The challenge is for us to seize the opportunity and CREATE a new future for learning. This inevitably means striking out in new directions, and for that we will need a beacon to guide us. Such a beacon must illuminate something that is powerful and compelling. It must tell us when we are succeeding and when we are being distracted. It must guide our use of technology towards meaningful learning, and away from faddishness. It must energize us to take on challenges that always come with striking out in new directions. Above all it must be right for the people at the heart of our endeavor – the students.*
>
> *There is such a beacon, and it is found by looking at what we all know in our hearts to be true: each child is different, and all children deserve the best we can offer to support their unique aspirations and needs for learning. We know that learning occurs best when each child is challenged, supported and guided to use his or her own sense of discovering the world. Approaches that treat groups of children as if they were all the same, are created for our convenience, not theirs.*
>
> *We need to make one more commitment to our students and to ourselves – the early years of learning are too precious to be treated as second class in any way. The learning environments we provide our children must be at least as compelling as the environments provided for their health, their entertainment, their sports, their subsequent higher education and all of their other social needs. We must aspire to having students love being in their learning environment, because it is as rewarding and stimulating and as "cool" as the rest of their world. All of this, and it must make economic sense. So our beacon becomes:*
>
> ***By the year 2010, children will have access to a working and cost-effective learning environment adapted to their individual learning aptitudes and goals, which is as compelling as other parts of their environment, which helps them achieve their full potential in the world, and which is capable of being adapted and used worldwide.***
>
> *Please join us in creating new learning environments that meet this challenge. All it takes is the willingness to adapt some or all of your work to consciously reaching this goal, and a willingness to share your vision, ideas, results and questions with others in the EFL community, at* www.futureoflearning.org.

Appendix 1

Pavilion Leaders:

***Advanced Networking/Internet2 Pavilion**:*
Bill Mitchell, Executive Director, MOREnet, University of Missouri

***Art and Music Pavilion**:*
Robin Bargar, Director, Hexagram

***Collaboration and Communication Tools Pavilion**:*
Stan Silverman, Professor, New York Institute of Technology

***Digital Access and Opportunity Pavilion**:*
Tom Kalil, Special Assistant to the Chancellor, University of California, Berkeley

***Emerging Technologies Pavilion**:*
Margaret Riel, Senior Research, SRI International and Visiting Professor, Pepperdine University

Handheld and Ubiquitous Computing Pavilion:
Cathie Norris, Professor, University of North Texas; and **Elliot Soloway**, Professor, University of Michigan

***Math and Science Pavilion**:*
Bob Tinker, President, and **Carolyn Staudt**, Curriculum & Teacher Professional Developer, Concord Consortium

***New Models for Schools Pavilion**:*
Greg Marks, Director, Learning Systems, Merit Network, Inc.

***Student Leadership Pavilion**:*
Emily Boyd, ThinkQuest Internet Challenge finalist from Australia; **Laura Eckstein**, ThinkQuest Internet Challenge finalist from Minnesota; **Tobias Kohler**, ThinkQuest Internet Challenge finalist from Germany; and **Lynne Sueoka**, ThinkQuest coach and faculty, Moanalua High School, Hawaii

***Teacher Leadership Pavilion**:*
Diana Eggers, Executive Director, The Learning Space

Intellectual Rapporteurs:

Laura Breeden, Senior Project Director, Education Development Center

Tom Carroll, Executive Director,
National Commission on Teaching and America's Future

Milton Chen, Executive Director, George Lucas Education Foundation

Esther Dyson, Chairman, EDventure Holdings

Michael Jay, Principal, KnowledgeQuest Education Group

Ed Lazowska, Bill & Melinda Gates Chairman of Computer Science,
University of Washington

Tammy McGraw, Chief Executive Officer, Institution for the Advancement of Emerging Technologies in Education at AEL, Inc.

Doris Redfield, Vice President for Research and Development and Director, Regional Educational Laboratory at AEL, Inc.

Linda Roberts, Director of Educational Technology,
U.S. Department of Education (retired)

Patricia Wasley, Dean of the College of Education, University of Washington

Lisabeth Wilson, Director of University Libraries, University of Washington

To participate in the Exploring the Future of Learning Initiative, or to send comments regarding EFL Programs, please e-mail: Robert Sibley, Director of EFL Programs, sibley@advanced.org or Patrice Samara, Director of EFL Communications, samara@advanced.org.

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