Using Information Technology in Intelligence Development and Education in the 21st Century

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Introduction

2:35 – 2:55

→ Current Educational uses of Technology

2:55 – 3:15

→ Future developments in technology

3:15 - 3:25

→Questions and Answers

Early Training, ages 1-6

Children as young as 1 use the computer

- Computer software and even some Web sites are now designed specifically for children as young as age 2 or 3

- Computers are becoming more common in day care and early childhood centers.

- Are children at this age really ready to use a computer?

- Your child will probably let you know when they are interested in using the computer

- When they find a computer game fun, they are probably ready to start playing and learning.

- Do not worry if you child seems more interested in other activities right now. They are likely to have many chances to pick up computer skills over the next few years.

– Michael Gilchrist, MD

The main arguments in favor of early computer education:

- They present a totally new approach to learning
- That people with learning difficulties or physical handicaps are able to perform well in some areas where they otherwise could not
- That children who master the relevant techniques at an early age will be ready to enter the labor market well prepared
- That they will be in command of skills and information needed in modern life
- That they enjoy having ready access to these powerful tools, and that they learn the necessary skills easily and with enjoyment.

The main arguments against early computer education:

- Children who come to rely on mechanical means of learning lose the skill and enjoyment of using their individual and human potential for doing so.
- They get out of touch with their own cultural roots and lose their imaginative powers
- They come to confuse actual reality with virtual reality
- They are wasting their valuable childhood years in which they could be developing their human and intuitive powers and discovering life for themselves.

- Elizabeth Stutz

Reasons to work extensively on a computer early

- Wide exposure to information.
- Early familiarity with computers.
- Opportunity to solve challenges early.
- Opportunities to gain experience with many disciplines early.
- Communications capability with others.

Reasons to not work extensively on a computer early

- Detrimental effects - excessive time spent looking at its screen.
- Starting at eight, perhaps 15 minutes, not more than twice a day.
- Age 15 upwards being 90 minutes in a day, in two or three sittings, not more than 45 minutes at a time.
- In the opinion of older teenagers they regret not having had the opportunity to learn the mechanics of arithmetic,because they learnt on machines too early and had become dependent on these and lacked a basic understanding of the underlying principles.
- As these machines become more sophisticated and more widely used, so the human element in understanding of the principles and the key to problem solving, evaluation, estimating and other mental skills, diminishes. In this way human capabilities atrophy .

REINVENTING SCHOOLS - Philip M. Smith

To see the future of education, don't watch children in the average classroom. Watch children play a video game. You'll see them engaged, excited, interacting, and learning . They play computerized video games. They listen to music on digital compact disks.

Because of their immersion in a computerized world, children absorb information differently than their parents do. Instead of following information passively from beginning to end children interact with the new technologies.

They skip from place to place and draw connections. They construct their own realities by experimenting with what already exists.

To make the most of these technologies, we have to rethink education from the ground up.

The power of information technologies to reshape education already is becoming clear. In scattered locations around the country, schools are using these technologies and interactive multimedia to engage students more actively in learning and to teach them the skills they will need to thrive in an information-based age.

We are on the verge of a transforming event in education. The Internet is reaching the schools.More and more students and teachers are gaining access to a global web of information.

Books from around the world are at our fingertips. Already the Internet and other information technologies are bringing interactive instruction to schools in small towns, allowing students to build communities with their counterparts around the world, and forging links between schools and the communities around them.

Taking advantage of this new capability will require profound changes in the roles of teachers, students, and schools. Instead of being the repository of knowledge, teachers will be guides who help students navigate through electronically accessible information. They will use the new technologies to build networks with each other, with parents and students, with academic and industrial experts, and with other professionals.

Schools will look less like the factories they were set up to emulate and more like the workplaces of a postindustrial age.

The distinction between learning inside of school and outside will blur.

It will be too expensive to outfit every classroom with the latest technologies, even as their prices fall. Educators therefore need to tap into broadly available technologies. They need to apply home computers, television, and even video games to education. They need to take advantage of a growing body of educational software developed for the home.

Turning opportunity into reality requires four important changes:

- Industry must develop educational devices from comparatively low-price game hardware and software, thereby dramatically lowering the costs of such technologies.
- Communities and government should include technological change when setting the agenda for systemic change in education.
- Software-makers must tie the content of their products to quality information and the educational standards now being developed and implemented.
- And teachers must receive extensive training in how to use emerging information technologies.

I don't mean to imply that computers will solve all the problems of education. Many difficult issues will remain. But the new information technologies provide an unprecedented opportunity to re-examine how we educate our children. Schools cannot avoid the coming changes.

NEW DEVELOPMENTS IN LEARNING

- Universal computing in schools
- Remote Learning
- Virtual Schools
- Expanded digitization
- Expanded bandwidth

UNIVERSAL COMPUTING IN SCHOOLS

- In less than 10 years, we have gone from less than 15% of schools having computers for students to over 85%.
- Most students are now computer-literate.
- Computer training is mandatory now in most schools.
- The first college to require students have computers was at Carnegie-Mellon in 1983. Now it is expected in almost every college, and most school dormitories are now wired for the Internet.
- For a 40-year old adult, your children are now as comfortable with the computer as you are with television, and your parents were with radio.

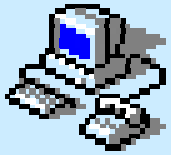
REMOTE LEARNING USING TECHNOLOGY

Classes and training can be taught via the internet.

Students in their own homes receiving information from instructors, sometimes highly skilled.

The same course can reach remote places. Students in America and Singapore can simultaneously be taught by a expert biologist in Brazil, with live photos from his current findings of rare exotic flowers or trees.

REMOTE LEARNING – PRO'S AND CON'S



Remote learning simply means learning at a distance.
A method of instruction conducted at a distance by a school or other qualified institution.

In the case of remote learning using the Internet, as with most other systems of remote learning, it is important to establish the credentials of the person or organization offering the tuition.

One of the advantages of using the Internet as the basis for a remote learning system is that learning materials should be available at all times.

A problem with all types of remote learning is that of social isolation. A student in a normal educational environment such as a college or University gains many advantages from social interaction with fellow students. Some of these advantages are directly related to the student's studies such as group exercises - **"Putting students into groups...compels them to explain their thoughts to one another and this has several advantages"**. One of these advantages is that students can often correct their own errors if they are forced to justify their opinions and reasoning to other people.

Another is that students are far more willing to engage in this kind of dissection of their work with other students than with their tutors general people skills which are of particular importance to students who have no experience of the work environment

it is widely acknowledged that students are much more likely to retain information that was learnt through a combination of multiple sensory experiences (hearing a lecture and reading slides, for instance).

VIRTUAL SCHOOLS

The Electronic Classroom of Tomorrow.

- ECOT is a Telecommunity School that has been awarded a charter to operate an internet based, distance learning school on a statewide basis.
- ECOT is available to all students age 5 to 23 residents of the State of Ohio.
- Each student enrolled in ECOT is provided the use of a complete computer system and all necessary peripheral devices needed to complete their assigned lessons.
- ECOT **does not** charge for tuition or for the use of any of the equipment.
- ECOT is managed by *Altair Learning.com*, a network management company that provides distance learning services and technology management to online Schools.
- We provide an exemplary curriculum, combined with utilizing the latest developments in leading edge technology.
- Please join us as we move into this new and exciting concept in public education.

Necessity of an Electronic Classroom Community School

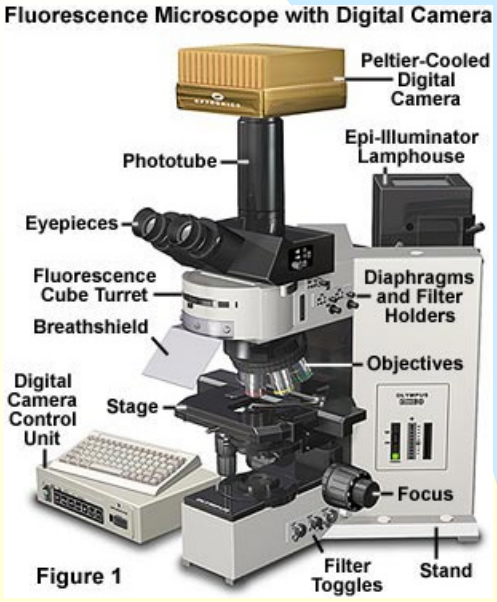
Over the past two years, advances in computer capabilities, Internetworking, software, and the availability of reference materials and text books in electronic form have made it feasible to provide high speed, reliable, and secure access to distance learning resources. The lowered costs and increased capabilities of home computer equipment makes it possible for the computer to not only be a classroom aid but to actually be the classroom or a major part of the teaching/learning experience. The computer and the Internet can also be a conduit for maintaining socialization programs for students and their families. Bulletin boards, on-line chat, news groups, and e-mail lists can facilitate and bring people together with common interests and from local regions to implement such things as sports programs, student clubs, learning spaces, parent support groups, and other extracurricular activities.

Traditional public education remains the best solution for many of Ohio's students yet technology is challenging the boundaries of the educational structures that have traditionally facilitated learning. ECOT is designed to meet the needs of many Ohio students who would not otherwise receive assistance from the State of Ohio or have the opportunity to complete graduation requirements for a high school diploma.

CURRICULUM

Language Arts
Social Studies
Comprehensive Arts Education
Science
Technology

EXPANDED DIGITIZATION



- Virtual microscopy
  A biology student can use technology in New York to study cell samples he took in Nairobi.

- Digital medicine
  A medical student can fully explore a digitized human body. A doctor can perform virtual surgery with robotics.

- Digitized music library
  There is a full music library at Indiana University.

- 3-D Engineering
  A German engineering student can examine a automobile engine in Detroit.

- Virtual astronomy
  An astronomy student in Kuala Lampur can move a telescope in Hawaii, and videoconference his findings to CapeTown.

Mauna Kea Observatory, Hawaii

EXPANDED BANDWIDTH

- Development of Internet 2 (Consortium of 77 universities).
- Development of New Generation Internet (USA Federal Funding).
- It currently takes 8 days to download the entire Encyclopedia Britannica now.
  With Internet 2 100X it will take 10 minutes.
- All-optical networks are now being developed.
  Lasers will transmit information through hair-thin fibers.
- Most modems now transmits data at 56,000 bytes per second.
  Laser transmission will transmit data at 4,500,000,000 bytes per second.
  This is approximately 70,000 times faster than what most people now experience.
- This is not a future dream. 200 companies are already using this.

EXAMPLE
OF USE OF LATEST
TECHNOLOGY –

NANOTECHNOLOGY

Nanotechnology Research

Controlling atoms from a distance

The Scanning Tunneling Microscope (STM) can measure and manipulate atomic structures (measured in nanometers, or billionths of a meter), whose images have been magnified to a workable human scale. The Field Ion Microscope (FIM) is used to shape the STM's probe, or tip, so it can accurately measure these structures.

SPONSOR

- NIST

PERFORMERS & PARTNERS

- EMCOR
- Kurt J. Lesker Co.
- Sandia National Laboratories
- NIST
- Topometrix
- University of Maryland

USERS & USES

Manufacturing researchers use the STM and its close relative, the Atomic Force Microscope, as quality control tools for developing standard measurements of small-scale products and their component parts, such as computer chips and their circuitry.

NGI RESEARCH NEEDS

A high-speed, secure, reliable network and simultaneous voice, video, and data transmission to make these microscopes, located at NIST's Gaithersburg, MD campus, accessible by "remote control" to companies and universities nationwide.

Primary Contact: Theodore Vorburger, NIST/MEL

Web Site: http://www.nist.gov/mel/nsm/

Internet2 and Indiana University

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EXAMPLE OF
USE OF LATEST
TECHNOLOGY –

REMOTE VIEWING OF
BRAIN ACTIVITY

Real-time Functional MRI

Watching the brain in action

The Brain in Action allows remote viewing of brain activity while a patient is performing cognitive or sensory-motor tasks.

SPONSORS

- NIH
  - National Center for Research Resources
  - National Institute of Mental Health
  - National Institute on Drug Abuse
- NSF

PERFORMERS

- Carnegie Mellon University
- Pittsburgh Supercomputing Center
- University of Pittsburgh
- University of Pittsburgh Medical Center

USERS & USES

Neurosurgeons, neurologists, psychiatrists, and brain scientists will investigate brain function and diagnose and treat brain diseases. For example, this application will enable neurosurgeons to develop surgical plans for tumor removal based on an understanding of the cognitive and sensory-motor abilities located near a tumor site.

NGI RESEARCH NEEDS

Improvements in available capacity, interactive real-time capability, security, privacy, and integration with advanced computing to ensure high performance, wide-spread availability, online visualization, and patient confidentiality.

Primary Contact: Nigel Goddard, Pittsburgh Supercomputing Center

Web Site: http://www.psc.edu/science/goddard.html

Internet2 and Indiana University

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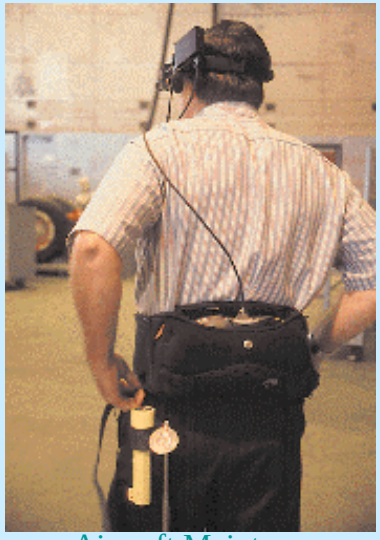
CURRENT WEARABLE COMPUTER SYSTEMS
Developed at Carnegie-Mellon University

Speech Recognition
Navigating through blueprints
Learning user's habits



Aircraft Maintenance

Speech Recognition
Verbal control of presentation

Language translation
Human intelligence data collection
Interactive electronic technical manuals
Operation of a C-130 help desk
Medical crisis response system

3-D FAX MACHINES

Stanford's Computer Graphics Laboratory have made and faxed three-dimensional computer models of objects that are so detailed they can be used to make accurate physical facsimiles of the original.

Potential applications including computer graphics for movies and video games, home shopping, and the duplication of rare artifacts or engineering prototypes.

Researchers scanned a 6-inch-high plastic sculpture of a "happy Buddha" and converted it into a 3-D computer model. They then transmitted the model electronically to 3-D Systems in Valencia, Calif., a company that uses a commercial process called stereolithography to create plastic models. Over the weekend the company created a facsimile.

The basic process began with placing the Buddha on a black platform. A line of sparkling, ruby-red light traced the statue's surface as the platform carried it through the plane of laser light. Scans were made from dozens of different orientations to get enough information to convert them into a highly detailed three-dimensional computer model. Once such a model is created, it can be sent electronically to factories that have the equipment to convert it into a physical object.

FUTURE DEVELOPMENTS IN COMPUTER TECHNOLOGY

- Conversing with your house
- Neurocomputers
- Quantum computers

CONVERSING WITH YOUR HOUSE

Every appliance will interact with you.
This will be done using Internet 2.

Every appliance may be connected to the Internet.
The internet code is now 12 digits (v4). It will shortly be expanded to 18 digits (v6)

You can turn on the coffee or cook a steak from the equivalent of your cell-phone
(which may be on your wrist or be a part of your shirt collar.

You can talk to your car, and direct it where to go.

Students will be able to see their school rooms or read a book through their virtual glasses.

NEUROCOMPUTERS

Merger of biological neurons and silicon chips.

Use neurons in conjunction with micro-circuitry.

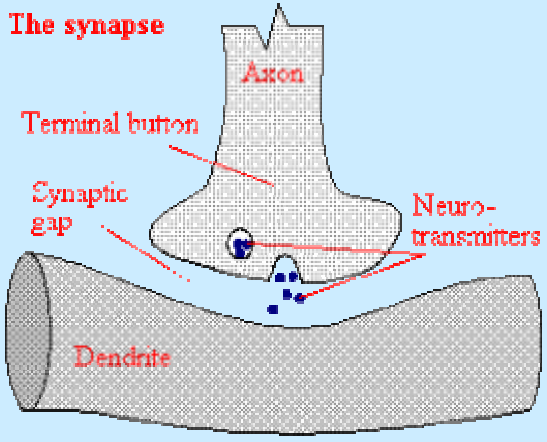
Neurocomputing technology can have computers learn,
Using the biological function of neurons.

A neuron can be in thousands of different states, as opposed to only two states
Available in a transistor.

Each synaptic connection can have up to 200,000 channels.

A micro-procesor can send a signal to a neuron directing it which state to be in.

This is very preliminary research, but it is being worked on at
Georgia Tech and Emory University.



QUANTUM COMPUTERS

Quantum computers store data in qubits. A qubit can have many states, not just 0 and 1.

The largest quantum computer now consists of 5 bits – 5 fluorine atoms.

It solved the “order-finding” problem in one step, impossible to do with any other computer. This requires many iterations on regular computers.

IBM's 5-bit quantum computer used the spin configuration in fluorine atoms to represent qubits. Logic is performed in any quantum computer when its qubit atoms affect the spin of neighboring qubit atoms. When structured properly, the quantum-computer atom can perform a number of mathematical operations in parallel.

Quantum computers may someday be able to live up to their potential of solving, in remarkably short times, problems that are so complex that the most powerful supercomputers couldn't calculate the answers even if they worked on them for millions of years."

- 95% of all scientists who ever lived are alive today.
- If the automobile industry moved at the speed that the computer profession has, a Cadillac would cost $12 today.
- Computers have been doubling in speed every 18 month's (Moore's law).
- This is now being surpassed. Technology is moving faster than before.
- This is a world-wide phenomena, affecting the lives of everyone. The world is now integrated through technology.

All civilized people know we know live on “Spaceship Earth” – a term coined by Mensa’s former Honorary International President – Buckminister Fuller.

Education is the key that will have the generations understand the new world, and be able to rule technology, rather than be ruled by it.

Only those who understand technology will be able to master it, and not be mastered by it.

Asia Room, US Library of Congress