Students and the Transformation of Higher Education

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Today's learners

- Connected: "Why would I call someone when I can talk to eight people at the same time on IM? LOL." Nathan T.
- Experiential: "Oh my gosh—I cannot sit through a lecture with nothing but a talking head. Oh my Gosh!" Alexis R.
- "Kids:" "Don't assume we can put a formula into Excel. Or that we know how a wiki works. Sometimes it's just new to us." Adam H.

—Windham, 2007

Time not spent in class

- Undergraduate students spend only 7.7% of their time in formal learning environments
- Grad students spend 5.1% in formal learning environments
- Who are the educators?
  - —Faculty
  - —Academic advisors
  - —Student affairs staff
  - —Students
  - —Community members

—Dey, 2008

Social networks

- **MySpace**
  - —73 million US visitors in March '08
  - —Averaged 76% of all social networking site visits in 2007
  - —3rd most popular site in the US
- **Facebook**
  - —36 million US visitors in March '08,
  - —6th most trafficked site / 2nd most trafficked social networking site globally
  - —85% market share among US four-year universities
- **Flickr** (as of April '08)
  - —46 million monthly visitors globally
  - —2 to 3 million pictures uploaded daily
  - —2 billionth photo uploaded Nov. '07

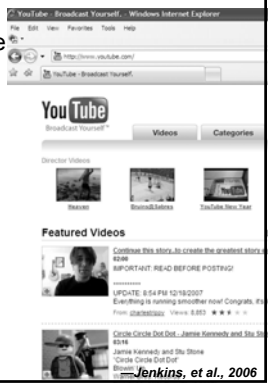
Games

- ***63%*** of Americans play video games
- ***67%***: heads of households play computer and video games
- ***70%***: percentage of major employers who use interactive software and games to train employees
- ***33***: average age of a player; has been playing for 12 years
- ***$9.5 billion***: gaming industry revenue in 2007

—ESA, 2008; image courtesy of Rhoten, 2008

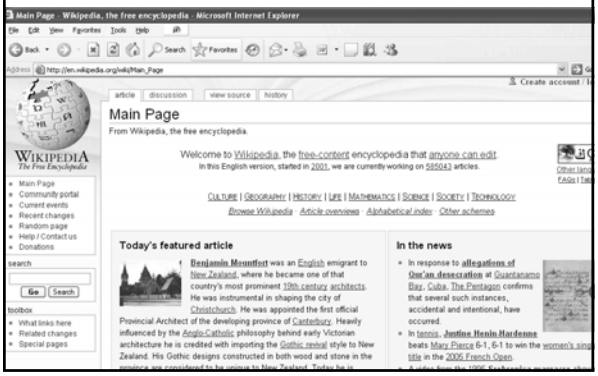
Media creators

- ***57%*** of American teens are media creators (created a blog, web page, posted art work, photos, remixed content into own creation)
- ***33%*** share what they create online with others
- ***22%*** have own web site
- ***19%*** blog
- ***19%*** remix online content



—Jenkins, et al., 2006

Amateurs as authorities



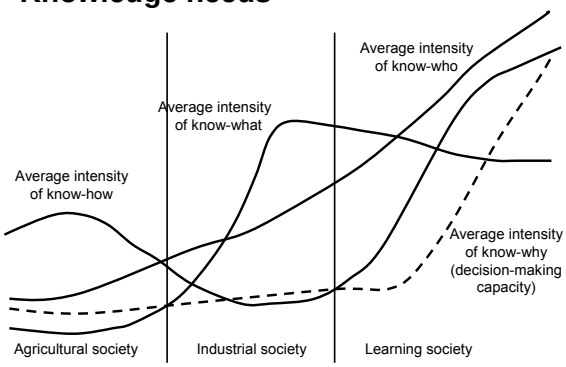
Participatory culture

- Collective intelligence: everyone has something to contribute
- Knowledge is created not possessed
- Shift in emphasis, e.g., wikipedia is a process not a product
- Social connections are important
- Need "skills for participation" (e.g., social skills; cultural competencies) not just individual skills
- Age doesn't matter; a "newbie" can be 60 and the expert 16

—Jenkins, 2008

Rethinking learning

Knowledge needs



—Miller OECD, 2003

Definition of learning

- Experiences (learning-by-doing) may be more important than information (active learning vs. assimilation)
- Knowledge is distributed across a community rather than held by an individual
- Assessment through reputation, experiences and accomplishments rather than tests
- Self-directed, informal, web-based environments

—Dede, 2006

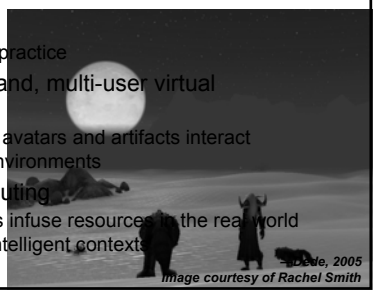
Contextual constructivism

- It is not possible to separate learning from context
- Context is an interaction between the learner and local surroundings
- Students build an understanding of context in context
- Context is both embedded (that which surrounds) and interactive (weaving together)
- Learning and context shape each other

—Finkelstein, 2001

Learning interfaces

- World to the desktop: access to
  - —Distant experts
  - —Collaboration
  - —Mentors
  - —Communities of practice
- Alice in Wonderland, multi-user virtual environment
  - —Participants and avatars and artifacts interact
  - —Shared virtual environments
- Ubiquitous computing
  - —Wireless devices infuse resources in the real world
  - —Smart objects; intelligent contexts



—Dede, 2005

Image courtesy of Rachel Smith

Infrastructure based on learning

- Learning based on student interactions with
  - —Complex data
  - —Systems
- Learning is influenced by context
- Different disciplinary ways of thinking
- Virtual labs/virtual worlds
- Mixed reality environments
- Spectrum of experiences (formal, informal)

—Borgman et al., 2008

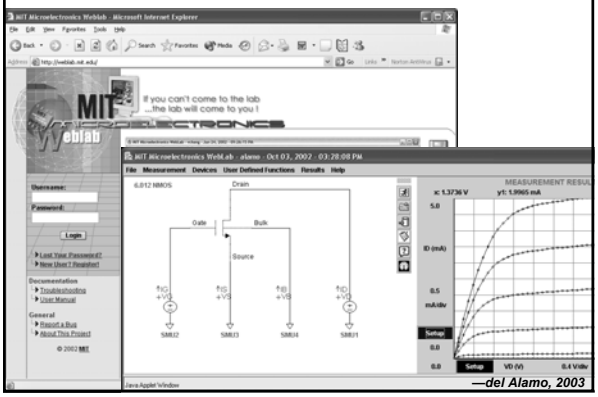
Education 3.0

Characteristics	Education 1.0	Education 2.0	Education 3.0
Primary role of professor	Source of knowledge	Guide and source of knowledge	Orchestrator of collaborative knowledge creation
Learning activities	Traditional essays, assignments, tests, some group work within classroom	Traditional approaches transferred to more open technologies; increasing collaboration in learning activities	Open, flexible learning activities focused on creating room for student creativity; social networking outside traditional boundaries
Institutional arrangements	Campus-based with fixed boundaries between institutions	Increasing collaboration between universities	Loose institutional affiliation and relations; regional and institutional boundaries breakdown
Student behavior	Largely passive and absorptive	Passive to active, emerging sense of ownership of the educational process	Strong sense of ownership of education, co-creation of resources

—Brown, 2008

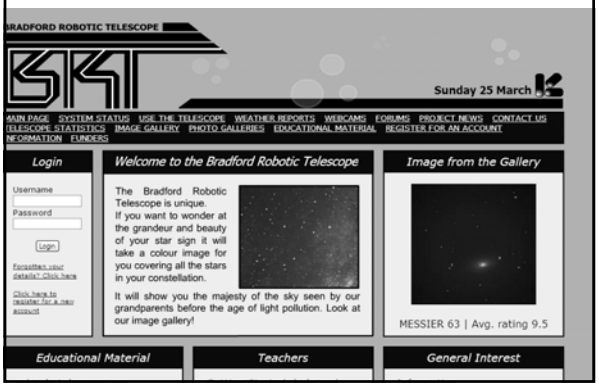
Real world

Remote instruments



—del Alamo, 2003

Virtual observatory

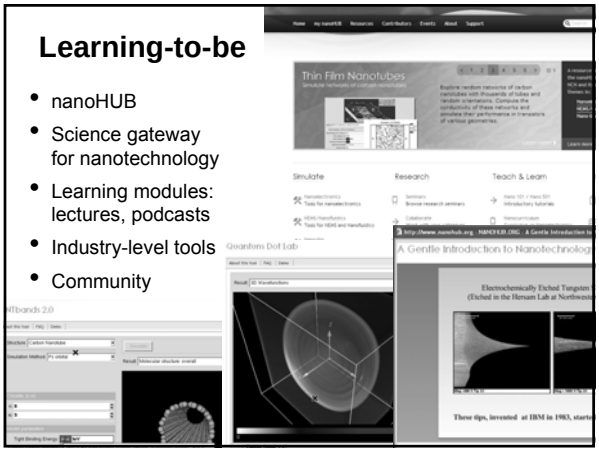


Earthquake collaboratory

- Network for Earthquake Engineering Simulation (NEES)
- National collaboratory: a distributed research center
- Advances understanding of how earthquakes and tsunamis affect man-made infrastructure
  - —Roads
  - —Buildings
  - —Port facilities
  - —Public utility systems
- Shared, community-wide data system
- Open system for community contributions

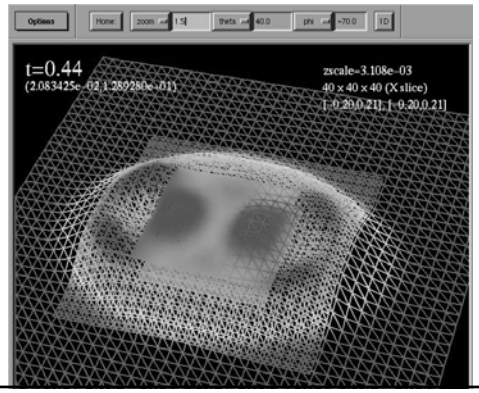
Learning-to-be

- nanoHUB
- Science gateway for nanotechnology
- Learning modules: lectures, podcasts
- Industry-level tools
- Community



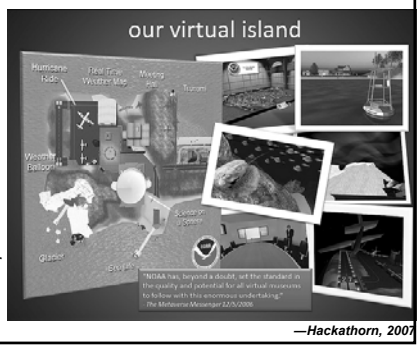
Sensory rich

Visualization



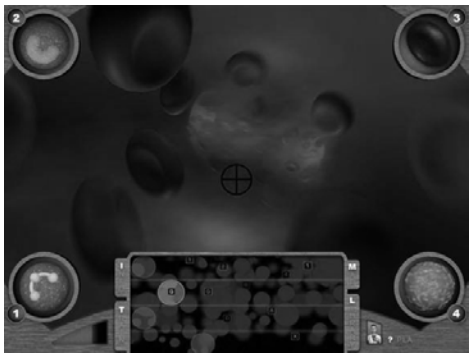
Experiencing weather

- Material developed by NOAA in Second Life
- Experiential learning and discussion
  - —Tsunami
  - —Hurricane
  - —Ice sheet melting
  - —Underwater explorer
  - —More



—Hackathorn, 2007

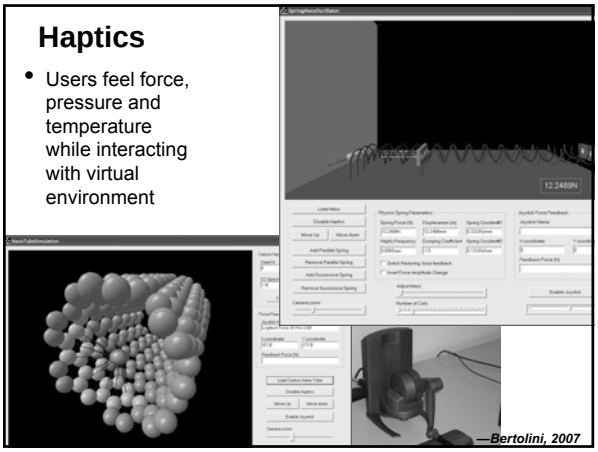
Serious games: Immune attack



—image courtesy of Marc Prensky

Haptics

- Users feel force, pressure and temperature while interacting with virtual environment



—Bertolini, 2007

Create and collaborate

Digital storytelling

- Expression through narrative
- Offers students an opportunity for expression using multiple media
- Encourages reflection, integration and synthesis
- Individual or group projects

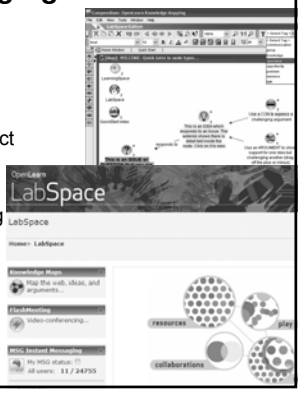
Virtual worlds

- Online, 3D virtual world
- Social presence with others
- Explore, meet others, socialize, participate in group activities
- Conversation, reflections, role-playing

—Knell & Cook, 2007

New options emerging

- Free, remixable Open University course materials
- Social networks
  - —Create list of personal interests in profile; connect to other learners with similar interests
  - —IM for informal learning through social networking and peer support
- Web 2.0 tools
  - —Compendium (visual thinking)
  - —Cohere (knowledge management)



Virtual organizations

- Distributed across space: participants span locales and institutions (can include 'citizen scientists')
- Distributed across time: synchronous and asynchronous
- Computationally enabled: collaboration support systems
- Computationally enhanced: simulations, databases, analytic services

—NSF, 2008

Space establishes context

Collaborating not just listening

—image courtesy of [illegible], Iowa State University

Joint problem-solving

—image courtesy of Hal Abelson, MIT

Group work areas

—image courtesy of University of Central Florida

Learning about learning

Metacognition improves learning

- Metacognition involves thinking about one's own cognitive processes
  - —Thinking
  - —Learning
  - —Reasoning
  - —Problem solving
- Metacognition is essential for effective learning in complex situations
- Effective learning involves
  - —Planning and goal-setting
  - —Monitoring one's progress
  - —Adapting as needed

—Lovett, 2008

Self-assessment

How much did each of the following help your learning?

Studying individually	☐ ☐ ☐ ☐ ☐
Studying with a partner	☐ ☐ ☐ ☐ ☐
Studying with a group	☐ ☐ ☐ ☐ ☐
Receiving help from a TA	☐ ☐ ☐ ☐ ☐
Receiving help from an instructor outside of class	☐ ☐ ☐ ☐ ☐

After finishing this course I am confident I can:

Discuss scientific concepts with friends	☐ ☐ ☐ ☐ ☐
Think critically about scientific findings	☐ ☐ ☐ ☐ ☐
Determine what is valid—and what is not—scientifically	☐ ☐ ☐ ☐ ☐

—SENCER project

"Homework wrapper"

- Students answer questions just before homework
- Complete homework as usual
- After homework, answer self-assessment questions and draw their own conclusions
- "This homework is about vector arithmetic… How quickly and easily can you solve problems that involve vector subtraction?"
- "Now that you have completed this homework, how quickly and easily can you solve problems…?"

—Lovett, 2008

"Exam wrapper"

- Upon returning exam, students completed exam reflection sheet in class
  - — Report study strategies, analyze errors, identify new approaches as needed
- Before the next exam, sheets returned to students for review and consideration, and students made a study plan
- Majority of students reported using new strategies

—Lovett, 2008

The Commons

Open educational resources

- Freedom to
  - —Share
  - —Reprint
  - —Translate
  - —Combine
  - —Adapt

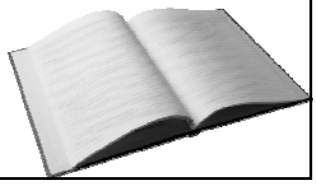
—Borgman et al., 2008

Rethinking assumptions

- OER challenges assumptions about knowledge, originality and ownership
- How open is "open"?
  - —Fixed by the author?
  - —Top down approach to content creation? Or shared across a network?
  - —Limited distribution or use?
  - —Modifiable for local conditions/culture?
  - —Available for repurposing?
- How is quality determined?
  - —Inherent in the resource itself?
  - —Emerges based on use?

Self-publishing

- Compliments publishing industry
  - —Allows more voices to be heard
  - —Serves small, non-profitable markets
  - —Goal is to have a million authors who sell a few books rather than a few authors who sell a million books
- Self-publishing marketplace

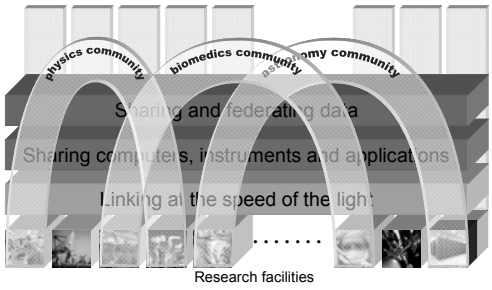


Need for enabling infrastructure

- Advance ability of scholarly community to interact, collaborate and explore
- Support interactive and experiential teaching and learning
- Harness distributed computing resources that cannot be supported by individual campuses
- Create international network of resources
- Enable new forms of scholarly inquiry and education

—Bottum et al., 2008

Infrastructure for discovery



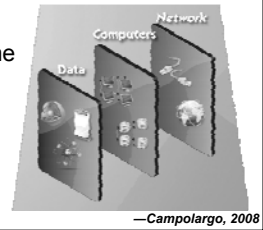
—Campolargo, 2008

Sensor networks

—McCartney, 2008

Data as an infrastructure

- The amount of data is doubling every year
- Large collaborations are emerging to collect and aggregate data
- E-research is emerging; computational techniques are essential
- Scientists need to be at home with their discipline, but also data management and computational skills



—Campolargo, 2008

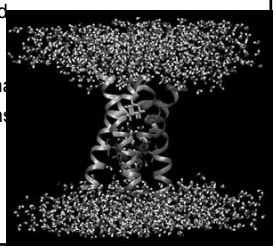
Structure of repositories

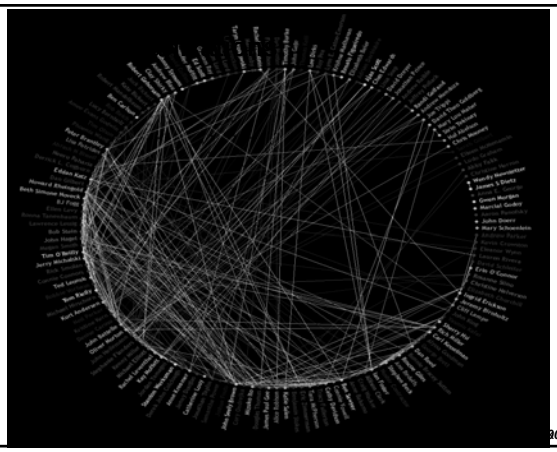
Category	Description
Information	Collections: data, work flows, publications, learning materials, etc.
Repository services	Deposit, annotation, delivery, visualization, search, help, etc.
Repositories	Repository management, curation, physical security, etc.
Access	Authentication, authorization, logical security, federation, portals, etc.
Management	Grids, virtual organizations, etc.
Physical infrastructure	Networks, computing, HPC, physical storage, etc.

—Campolargo, 2008

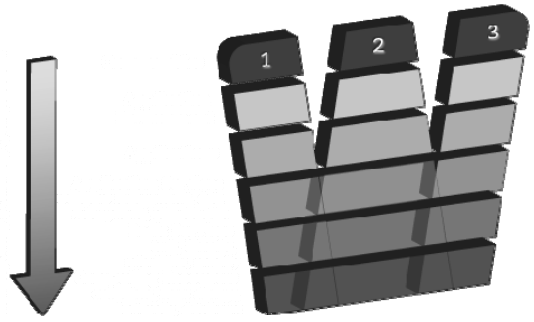
Distributed infrastructure

- TeraGrid: Open, distributed scientific discovery infrastructure—brings campus resources together in grid
- Low-threshold access to more resources than a campus could afford individually
- Distributed facility; resources independently owned and mana
- 100+ discipline-specific databas
- Enable communities to use resources through a common interface





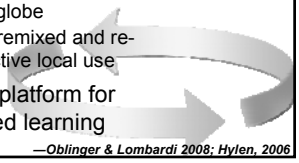
Leveraging investments



—McCartney, 2008

Global commons

- Sharing content is only the first step
- Adopt principles of connections, co-creation and distributed cognition
- Networked community of instructors and students who pool resources
  - —Evaluated and ranked by community
  - —Distributed across the globe
  - —Sampled, mashed up, remixed and re-contextualized for effective local use
- University becomes a platform for collaborative, supported learning



—Oblinger & Lombardi 2008; Hylen, 2006

Institutions falter when they invest too much in "what is" and too little in "what could be."

—Hamel & Valiksngas, 2003

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