Wisdom is not the product of schooling but the lifelong attempt to acquire it. - Albert Einstein

Human-Centered Computing
and
Rethinking Learning and Education

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November 1, 2010

Rethinking Learning and Education

- school learning $\rightarrow$ lifelong learning
- unaided individual human mind $\rightarrow$ distributed intelligence
- reflective practitioner $\rightarrow$ reflective community
- “gift-wrapping” and “techno-determinism” $\rightarrow$ socio-technical environments
- consumers $\rightarrow$ active contributors (meta-design)
- learning when the answer is known $\rightarrow$ learning when no one knows the answer (social creativity)
## How the World Has Changed

<table>
<thead>
<tr>
<th>dimension</th>
<th>old paradigm</th>
<th>new paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>information</td>
<td>scarce</td>
<td>plentiful</td>
</tr>
<tr>
<td>reproduction of documents</td>
<td>expensive and restricted</td>
<td>cheap</td>
</tr>
<tr>
<td>specialization</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>change within a human life time</td>
<td>slow</td>
<td>fast</td>
</tr>
<tr>
<td>interaction / collaboration</td>
<td>physical proximity</td>
<td>shared professional interests</td>
</tr>
<tr>
<td>economy</td>
<td>rigid, hierarchical organizations</td>
<td>dynamic economy, flexibility, networking</td>
</tr>
<tr>
<td></td>
<td>long-term personal identity</td>
<td>no long-term</td>
</tr>
</tbody>
</table>
Old Model: Learn in School what is Needed in Life
Problem with the Old Model in Today’s World
—
Coverage and Obsolescence
What's Wrong with the Universities of Today

- **lecture dominated** — emphasizing passive knowledge absorption instead of active knowledge construction

- **curriculum dominated** — little room for authentic, self-directed learning activities

- students solve **given problems** — they do not learn to frame problems

- problems in school have **right or wrong answers** — problem in the real world are wicked, ill-defined, ill-structured

- **closed book exams** — ignoring distributed cognition

- little emphasis on **collaborative learning and communication skills** — working together is regarded as “cheating”
Co-Evolution: Beyond “Technology-Driven Developments” and “Gift-Wrapping”
Stuck in “Giftwrapping” or “Technology-Driven Developments”

“There is nothing so useless as doing efficiently that which should not be done at all.” — Peter Drucker

- **“Giftwrapping”**
  - using technology as an add-on to existing practices → instead of fundamentally rethinking what education should and could be about in the future
  - “distance learning is different from classroom learning at a distance”
  - Classroom Response Systems (→ "Clickers")

- **Technology-Driven Developments**
  - “all schools on the Internet” → necessary, but not sufficient
Technology-Driven Developments
Clickers = Gift-Wrapping?

—a simple technology that works
Clickers

- **what are Clickers?**

- **The Research → Do clickers help students learn in the classroom?**
  - [http://www.youtube.com/watch?v=PxKHXyVtVIA](http://www.youtube.com/watch?v=PxKHXyVtVIA)
  - example: Clickers in the Science Classroom

- **claim:**
  - [http://www.engaging-technologies.com/clicker-research.html](http://www.engaging-technologies.com/clicker-research.html)
  - classroom clickers are a technology that does something teachers have wanted to do for many years - engage their students. We strongly feel that this technology will be around for a very long time because it changes the dynamics of the classroom!
Innovations

- **digital divide:** OLPC (=one laptop per child) = $100 computer

- **OpenCourseware (OCW),** Massachusetts Institute of Technology (MIT)
  - MIT is putting all its course content, undergraduate and graduate, into Web-based format (as an institutional commitment)
  - the OCW website will be open and freely available to the world
  - MIT will commit to OCW as a permanent, sustainable activity

- **iTunes U**
  - “learn anything, anytime, anywhere” → an innovative way to get educational content into the hands of students
  - value added:
    - simple to use (via iTune)
    - powerful and accessible learning tool for students with disabilities
An Example from MIT OCW Offerings

Teaching Real-World Programming

▪ how things are:
  - in undergraduate computer-science classes, homework assignments are usually to write programs, and students are graded on whether the programs do what they’re supposed to
  - teaching assistants look over the students’ code and flag a few obvious errors, but they rarely have the time coach the students on writing clear and concise code

▪ in the real world:
  - code clarity is as important as software performance
  - large software projects can involve hundreds of programmers → testing, revising and updating software may require people to review code that they did not write
  - if the code isn’t intelligible, engineers can waste a huge amount of time just figuring out how an existing program does what it does (also: design rationale research)

▪ how things could / should be:
  - in the innovative course “Teaching Real-World Programming”, students meet for regular “code reviews” with senior programmers from Boston-area companies
Challenges Created by MIT’s OpenCourseware —

Core Competencies of Residential Research Universities

- commoditizing the ‘content’ sharpens the focus on the substantive values of residential education: personal attention from faculty and participation in learning and research communities

- move away from large passive lectures towards active learning environments

- look beyond the simplicities of information to the complexities of learning, knowledge, judgment, communities, and organizations

- emphasize “learning to be” (in addition to “learning about”)
Michael Eisenberg: “University vs. YouTube — Redefining the Role of Physically Situated Education in the Internet Age”

- **claims:**
  - the role of the university -- the physical setting, the place that students actually attend -- is about to undergo seismic changes due to the presence of web-based phenomena such as iTunes U, Instructables, and YouTube
  - at issue is the meaning of physically-situated higher education when challenged by a vast menu of easily accessible, high quality, low cost (or free) web-based instructional materials.

- **theme for reflection:**
  - the ways in which physical setting can be put to educational use (often by means of novel technologies)
  - the way in which classroom instruction and university-level courses might evolve in response to their web-based analogues.
  - what residential university life can and should look like in the medium-term future.
Some Alternatives Scenarios to Classroom Learning based on Human-Centered Computing

- grounding of these approaches in:
  - I hear and I forget
  - I see and I remember
  - I do and I understand

- **Agentsheets** + LegoMindstorms + Projects + Play + Design + Communication → short movie (2 min)

- **Squeak**: teaching and understanding gravity → short movie (8 min)
Learning Webs

<< Illich, I. (1971) Deschooling Society — written 20 years before the WWW>>

- to conceive a different style of learning (complementing / replacing learning in schools) → a fact: people are learning many things outside of schools

- Illich’s objectives:
  - we can depend on self-motivated learning instead of employing teachers
  - we can bribe or compel students to find the time and the will to learn
  - we can provide learners with new links to the world instead of continuing to funnel all educational programs through the teacher

- use of advanced technology to support "learning webs"
  - “The operation of a peer-matching network would be simple. The user would identify himself by name and address and describe the activity for which he sought a peer. A computer would send him back the names and addresses of all those who had inserted the same description. It is amazing that such a simple utility has never been used on a broad scale for publicly valued activity.”
Criteria for a Good Educational System

- provide all who want to learn with access to available resources at any time in their lives

- empower all who want to share what they know to find those who want to learn it from them

- furnish all who want to present an issue with the opportunity to make their challenge known
Four Approaches

- **reference services to educational objects** — which facilitate access to things or processes used for formal learning

- **skill exchange** — permit persons to list their skills, the conditions under which they are willing to serve as models for others who want to learn these skills, and the addresses at which they can be reached

- **peer-matching** — a communications network which permits persons to describe the learning activity in which they wish to engage, in the hope of finding a partner for the inquiry

- **reference services to educators-at-large** — he addresses and self-descriptions of professionals, paraprofessionals, and free-lancers, along with conditions of access to their services
Distributed Cognition

- **between:**
  - human beings
  - humans and things (computational artifacts)

- **advantage of humans:**
  - shared understanding
  - background knowledge

- **advantage of things** (Illich):
  
  “a thing is available at the bidding of the user - or could be - whereas persons formally become a skill resource only when they consent to do so, and they can also restrict time, place, and methods as they choose.”

→ the “Nobel Prize Winner / Distant Learning” fallacy
## Existing Software Components for Learning and Using SketchUp

<table>
<thead>
<tr>
<th>Resource</th>
<th>Concept</th>
<th>Access Mode</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tip of the Day</strong></td>
<td>informal instruction</td>
<td>push, in application</td>
<td>highly visible, directed</td>
<td>easily dismissed, often irrelevant, not context aware</td>
</tr>
<tr>
<td><strong>Help Center</strong></td>
<td>self-directed, inquiry-based</td>
<td>pull, on web</td>
<td>passive community moderation, easily updated</td>
<td>not context aware, not available in-application</td>
</tr>
<tr>
<td><strong>SketchUp Help</strong></td>
<td>self-directed</td>
<td>pull, on web</td>
<td>complete reference (every tool, command)</td>
<td>you have to know what you're looking for, not context aware</td>
</tr>
<tr>
<td><strong>Status Prompts</strong></td>
<td>just-in-time, on demand</td>
<td>push, in application</td>
<td>context aware</td>
<td>invisible in the UI</td>
</tr>
<tr>
<td><strong>Tooltip</strong></td>
<td>just-in-time, on demand</td>
<td>push, in application</td>
<td>action context aware, highly visible</td>
<td>terse, context too tightly focused</td>
</tr>
<tr>
<td><strong>Instructor</strong></td>
<td>just-in-time, on demand</td>
<td>push, in application</td>
<td>tool context aware, attracts attention</td>
<td>user must activate, tool context only (not modeling context)</td>
</tr>
<tr>
<td><strong>Quick Reference Card</strong></td>
<td>just-in-time, on-demand</td>
<td>pull, in install</td>
<td>high data density, visual reference</td>
<td>invisible, must be printed to be useful</td>
</tr>
<tr>
<td><strong>User Forums</strong></td>
<td>community, apprenticeship</td>
<td>pull, on web</td>
<td>long tail support, personal, can be encouraging</td>
<td>can be grumpy, no immediate response</td>
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</thead>
<tbody>
<tr>
<td>Video Tutorials</td>
<td>programmed</td>
<td>pull, on web</td>
<td>popular, combinations of tools, watching an expert</td>
<td>passive, technological demands, too long, not search-able</td>
</tr>
<tr>
<td>Self-Paced Tutorials</td>
<td>self-directed, learning by doing</td>
<td>pull, in application</td>
<td>in program, self-paced but guided by examples</td>
<td>mistakes can derail learning</td>
</tr>
<tr>
<td>Live Training</td>
<td>formal instruction</td>
<td>push/pull, at physical locations</td>
<td>interaction with an expert</td>
<td>expensive, strict schedule</td>
</tr>
<tr>
<td>Tech Support</td>
<td>inquiry-based, constructionist</td>
<td>pull, on web</td>
<td>personalized, builds Help Center</td>
<td>have to ask the right question</td>
</tr>
<tr>
<td>Error Messages</td>
<td>learning by being told</td>
<td>push, in application</td>
<td>context aware</td>
<td>Often too cryptic and/or annoying</td>
</tr>
<tr>
<td>Menu System</td>
<td>discovery</td>
<td>pull, in application</td>
<td>visible, discoverable, complete reference</td>
<td>terse</td>
</tr>
<tr>
<td>Toolbars</td>
<td>discovery</td>
<td>pull, in application</td>
<td>visible, discoverable</td>
<td>terse, icons don't easily map to actions</td>
</tr>
</tbody>
</table>
Video Tutorials: New to Google SketchUp

Part 1 - Concepts (3:08)


A great starter video for anyone trying Google SketchUp
Web 2.0: Social Production and Mass Collaboration

- **source:** Tim O’Reilly “*What is Web 2.0 — Design Patterns and Business Models for the Next Generation of Software*”

<table>
<thead>
<tr>
<th>Web 1.0</th>
<th>Web 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britannica Online</td>
<td>Wikipedia</td>
</tr>
<tr>
<td>personal website</td>
<td>blogging</td>
</tr>
<tr>
<td>publishing</td>
<td>participation</td>
</tr>
<tr>
<td>content management systems</td>
<td>wikis</td>
</tr>
<tr>
<td>scheduled software releases</td>
<td>continuous improvements</td>
</tr>
<tr>
<td>individual contributions</td>
<td>collective intelligence</td>
</tr>
</tbody>
</table>

- **claim:** the participatory web (= Web 2.0) will fundamentally changing learning, teaching, and education by supporting cultures of participation based on meta-design
Many Open Interesting Questions and Research Issues

- what are the **cultural implications** as more and more people publish?

- is there a **limit** to how many people will publish?

**quality and trust**
- **open source software** versus commercial software
  - “if there are enough eye balls, all bugs are shallow”

- **Wikipedia** versus Encyclopedia Britannica
  - [http://www.nature.com/nature/journal/v438/n7070/full/438900a.html](http://www.nature.com/nature/journal/v438/n7070/full/438900a.html)

- South Korea's stem cell scandal → the results were published in **Science** and **Nature** (two of the most carefully reviewed journals)