Beyond the ownership of handhelds: one-to-one active learning with ubiquitous learning minds

Chen-Chung Liu

Outlines

- Mobile and ubiquitous learning
- Ecological change in our classrooms
- Ubiquitous learners and learning minds
- Environmental and Pedagogical Transformation
- Some experience and Developing Systems

# Mobile and ubiquitous learning

- The ownership of learning tools will change the way people learn and teach
    - Paper and pencils came to classrooms in the past
    - The presence of personal computing devices will also change how people learn and teach in classrooms

- It strongly associates itself with hardware ownership and the learning of specific domain with handheld devices

- But little has been emphasized about the minds to exploit the new tools for enhancing learning experiences
    - Activeness, collaboration, contribution, and social intelligence

One-to-one learning

One-to-one learning: The scenarios where students bring handheld devices fitted with wireless communication capabilities and apply these devices for various learning activities.

ASUS Eee PC (USD. 240)
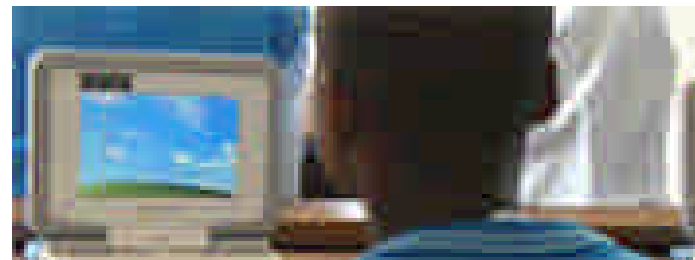
Intel Classmate PC

MIT OLPC(USD. 100)

One-to-one learning

G1:1 --- Global Network of Collaborative Research on 1:1 Educational Computing, NCU Graduate Institute of Network Learning Technology

Some examples in Taiwan

- ## Digital Classroom Environment (Tak-Wai Chan, Chen-Chung Liu)
  - Connecting learning peers and teachers with PDAs, Tablet PCs, Clickers, Large-displays, Digital pens, or E-puppets

Some examples in Taiwan

- ## Bird/Butterfly watching

  - – Providing wild life exploration aids and assessment with PDAs and databases

Some examples in Taiwan

- Ecology exploration
 - Data gathering and sharing with PDAs and digital cameras

Handhelds Affordance

- Opportunities that transcend classroom learning
  - Reaching the world outside classrooms even when students are located in classrooms
  - Possibilities to contribute personal experiences to collective thinking
  - Extended minds in classroom

Classrooms before and now

A classroom 100 years ago
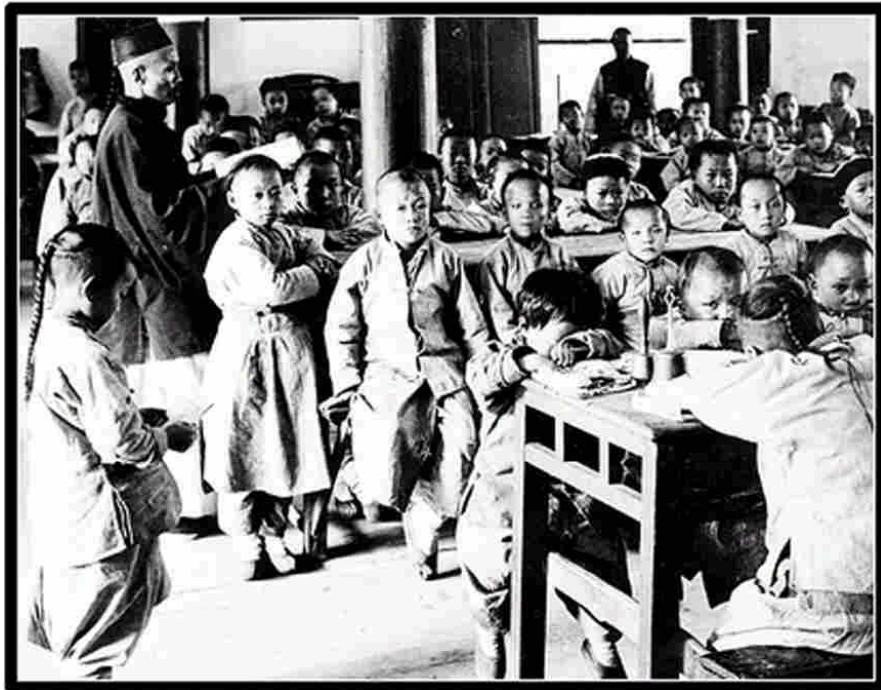
A classroom now

Chinese school children and teacher at the American Board of Missions, Peking, China -- Library of Congress Stereograph Collection

This class almost killed me --
http://flickr.com/photos/rachelskirts/2039554656/

Owners of devices

– Something beyond ownership of learning tools

– When computational power is everywhere, the mobility of devices and learners is no more an critical issue (in some countries).

– We could access computers and Internet, even we do not carry our own laptop computers.

– Mobile & Ubiquitous learning does not only refers to the learning scenarios with handheld devices and wireless network.

Ecological Change in our classrooms

	Paper & pencil	One-to-one
Activity autonomy	Single threaded and centralized	Multi-threaded and distributed
Activity awareness	Visible	Invisible
Learning material	Given by teachers	Available on the Internet
Learning tools	Textbook and pencil	Distributed cognition over the Internet
Connectivity	Close in classrooms	Open and connected to the world
Learning support	Individual mind	Social network
Continuity	Fragmented	Seamless

Activity autonomy & visibility

- ## Single-threaded & visible processes
  - Teachers look down at students' learning activity on papers and facial expression when they are teaching

- ## *Multithreaded* & invisible processes
  - Handheld devices and wireless network make the world at students' fingertips and give students more autonomy of learning activities.
  - The screens of handheld devices are generally invisible to the teachers and other peers.
  - Teachers have less control of student activity.

Activity autonomy & visibility

1. Increasing tense between the teacher-led activity and the desired way to learn
2. Changing the pedagogical design

or
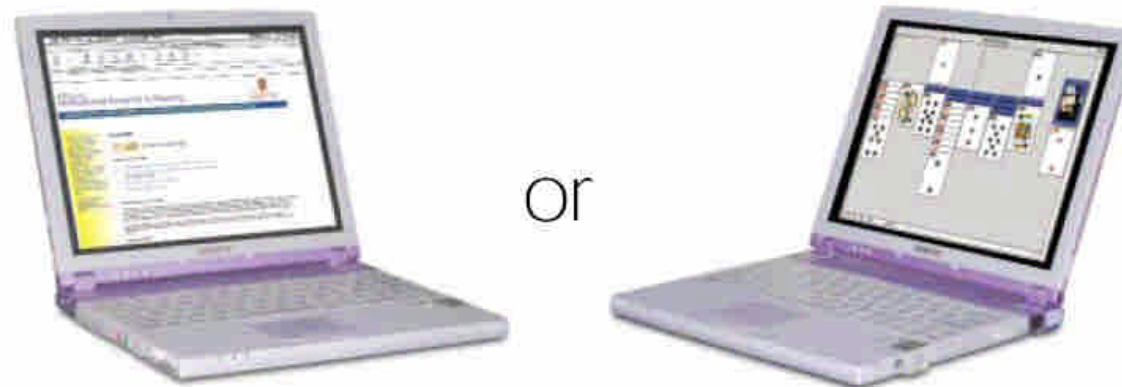
The Internet as class distraction -- Lougheed 2002

– *"One professor at a law school in Texas became so upset by the level of student distraction in 2001 that he took a ladder to school, climbed up to reach the wireless transmitter in his classroom -- and disconnected it. The students protested."* Schwarz, The New York Times January 2, 2003

Learning material and tools

- ## Open Source:
  - freely use, change, and improve it, and to redistribute it in modified or unmodified form.

- ## Freeware
  - use it free of charge, for an unlimited time.

- ## Donationware
  - Use it by donating to the programmer

- ## Beerware
  - use it by buying the author a beer

- ## Service on the Web
  - the authors gain the reputation by increasing the hit rate on the Web.

Learning material and tools

- ## Online tools
  - Over eighty thousands open software projects at Sourceforge
  - 103 mathematics software projects and 256 science-related software projects at Free Software Foundation
  - Biology: BLAST at NCBI
  - Physics: Virtual Physics Lab in Taiwan
  - Math: Math online in Austria
  - Geography: Google earth
  - General or developmental tools: Google translate, MSDN

- ## Online material
  - Up-to-date information, from primary resources, comprehensive, and represented in various format

- Do students' efforts in finding and using tools or information on the Internet are appreciated by teachers and current pedagogies?

Learning material and tools

- ## Online plagiarism

  "While the behaviors of asking others for help, copying answers and copying papers are encouraged in the workplace, they are regarded as plagiarism in our education system." – by Donald Norman

  What abilities/knowledge/mind set should be learned and assessed?

  What pedagogies can facilitate the learning of these abilities and knowledge?

- It become more important than before to adopt new pedagogies that encourage students to contribute their personal experience on the Internet and help develop high level epistemologies that turn passive information receivers into active critical thinkers.

Connectivity and learning supports

- Weak tie relationship
    - Connect all the potential resources that including the learning companions and other expert in virtual community
    - The user-to-user help in online community may bring field experience on the internet to enrich the learning experience in classrooms which usually focus on conceptual level of knowledge.

- Do the pedagogies commonly used today allow and encourage student to attain different perspectives and supports from the resources outside the classrooms and attribute credits to these resources?

Main challenge

- Provide the *pedagogical and environmental transformation* framework to accommodate the presence and optimize the use of one-to-one devices that
  - assist learners to learn and live with ubiquitous learning mind anytime anywhere
  - assist teachers to best use such devices to cultivate ubiquitous learning minds

Ubiquitous learners & learning minds

- The text of **Shui Jing Zhu**:
  - A work on the ancient geography of China, compiled by **Li Daoyuan** (472 -- 527)
  - Exploratory writing rather than by imaginary speculation
  - Over 300 thousands words covers the waterways of ancient China (1252 Rivers and over 500 lakes/fens)
  - Historical sites, figure history, myths, inscriptions, folk songs
  - The geographical text Inspired well-known poets to create of many literary masterpieces in Chinese history

Li Daoyuan (472 -- 527)
http://cs.ttcn.cn/
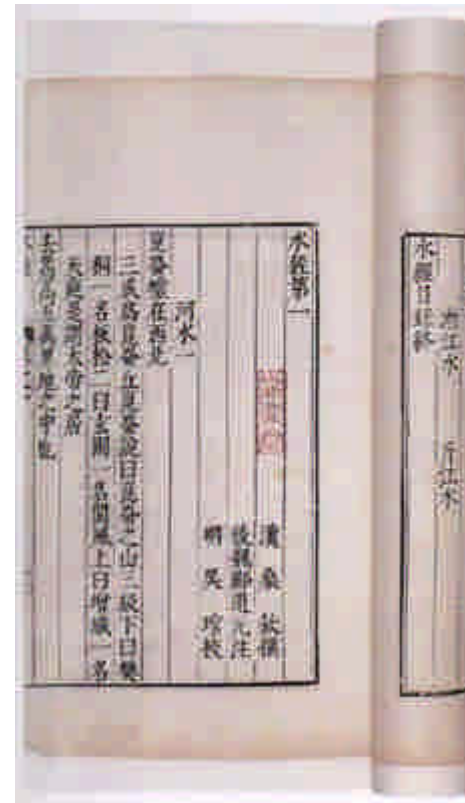
Shui Jing Zhu
http://www.chuanjiaoban.com/
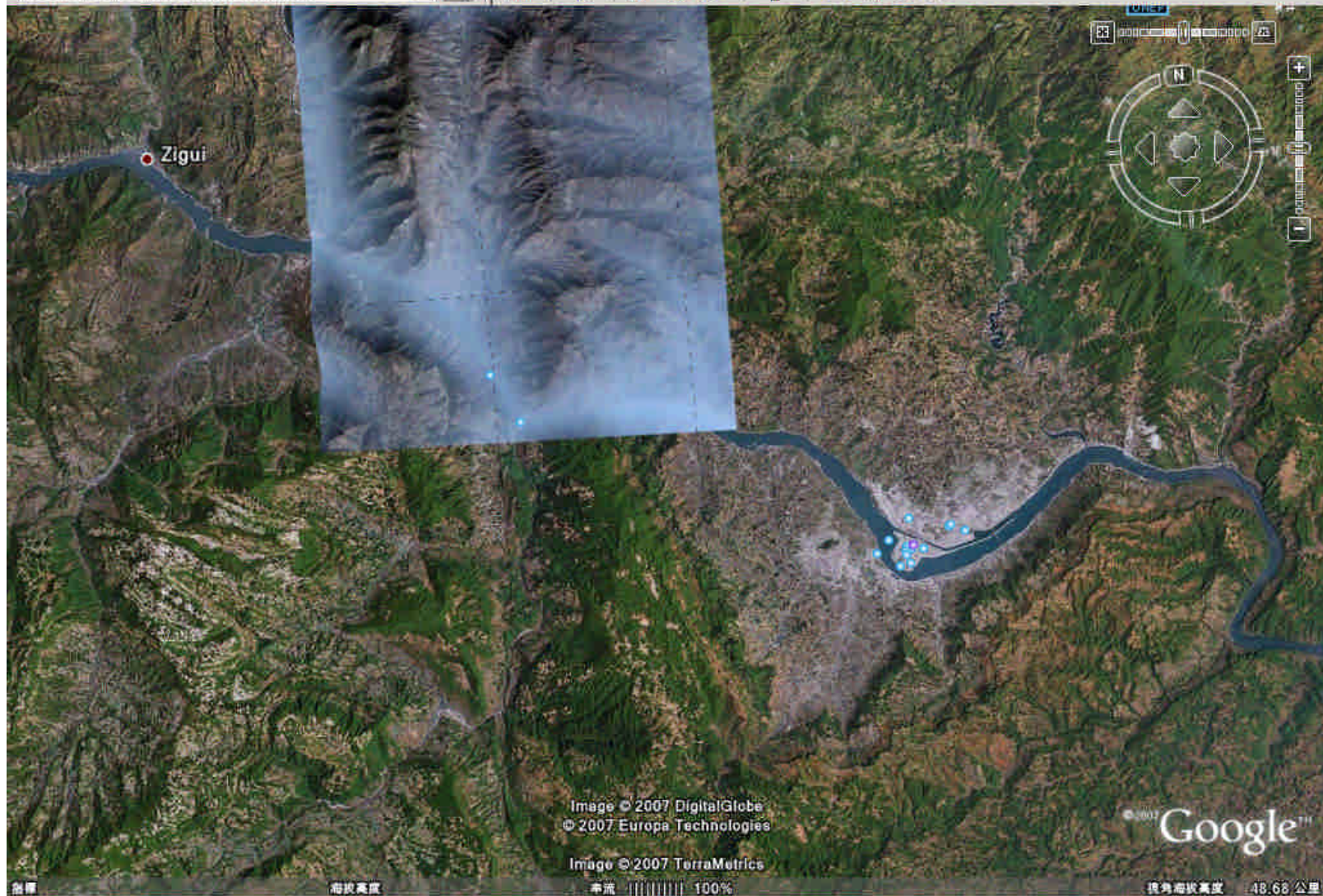
Shui Jing Zhu

自三峽七百里中，兩岸連山，略無闕處；重巖疊嶂，隱
天蔽日：自非亭午夜分，不見曦月。至於夏水襄
陵，沿泝阻絕，或王命急宣，有時朝發白帝，暮到
江陵，其間千二百里，雖乘奔御風不以疾也。

On both banks of the Three Gorges, 700 kilometers long, there are high mountains adjacent to one another, where you won't be able to see any light unless it's noon time. Between the starting and ending point, there were no roads anywhere, which makes it extremely difficult to travel. However, when the emperor has urgent order to be delivered, the messenger, traveling on water in length of 1200 kilometers, will be able to get the job done from sunrise to sunset, which is close to wind speed.

Shui Jing Zhu by **Li Daoyuan**

Ubiquitous learning minds

1. What mind set did the author demonstrate in order to achieve the great text without high technology but paper and brush pens?

- Personal autonomy & active engagement

- Collaboration & Social intelligence
  - The annotated text of an older text, Shui Jing.
  - It referenced 437 older texts and become the vital records for these texts when they were missing

- Epistemic pluralism
  - Reviewed older geography texts and explored the current reality in person while the geography of rivers changed over time.

2. Could everyone of us be such an creator having such good writing (or other) skills to create a great work?

Bloggers' perspective

Bloggers' perspective

NITLE Blog Census

2,865,107 Weblogs Indexed
1,890,970 Estimated Active

870,000 in 2004
based on Nardie et al.

Home

News

About

Methodology

Stats:

  Languages

  Map

  Market Share

Download

API

Credits

The NITLE weblog census is an attempt to find as many active weblogs as possible, across all languages

Current Status

Likely weblogs	2869632	Visited sites we think are weblogs
Anglo weblogs	1970366	Blogs that seem to be in English
Processes active	10	Number of crawlers running
Queue	1376668	Sites we know nothing about yet
Weblog Queue	3373662	To-do list of known weblog sites

Check your URL

Submit a weblog URL to make sure our crawler pays a visit

http:// [   ] [Check]

Latest News

Bloggers' perspective

- Why people blog (Bonnie Nardi et al., 2005)
  - Document my life
  - Digital cameras
  - A point of view, not just chatter
  - Outlet for personal thoughts and feelings
  - Thinking by writing

- What blogging inform us about learning?
  - Self-relevance
  - Applying new tools/technology
  - Linking myself to others
  - Making contribution publicly accessible

Confucianism's perspective

The Confucianism's book Da-Hseh

National Palace Museum http://www.npm.gov.tw/
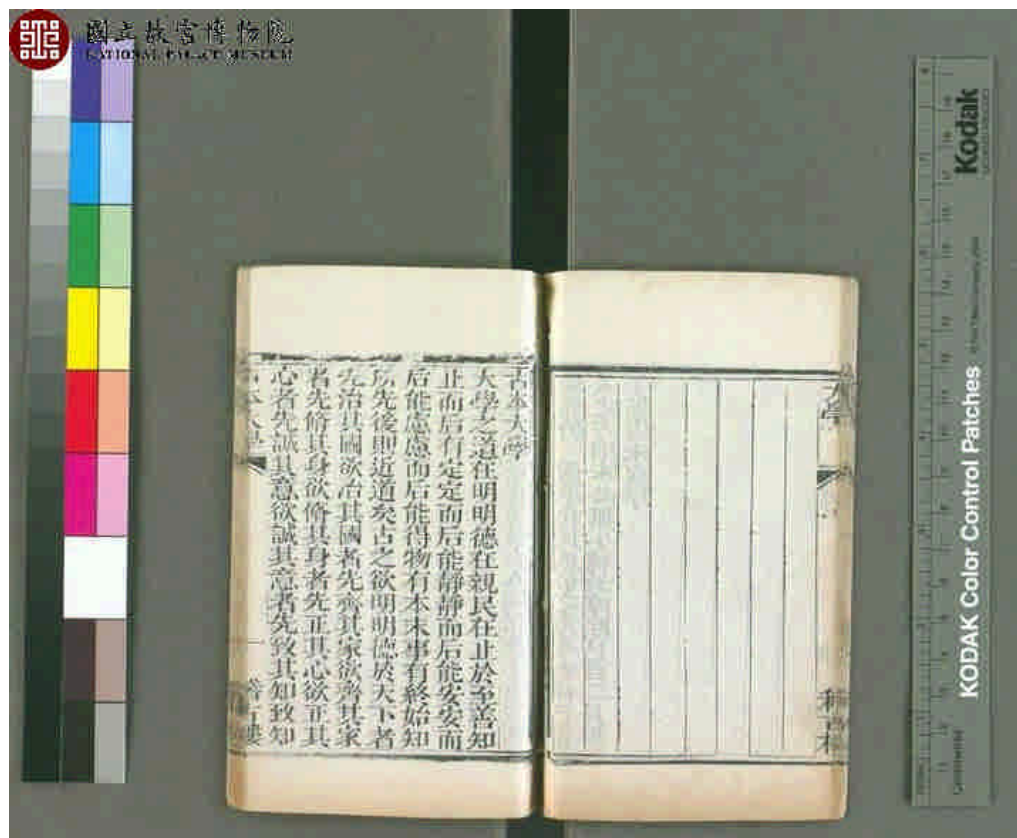
Confucianism's perspective

Da-Hseh
- The beginning of learning
- The same word as "University "in Chinese
- Linking science, knowledge, families, society, and the world
  - 古之欲明明德於天下(world)者，先治其國(country)；欲治其國者，先齊其家(family)；欲齊其家者，先脩其身(self)；欲脩其身者，先正其心(mind)；欲正其心者，先誠其意；欲誠其意(intention)者，先致其知(logic & knowledge)；致知在格物(artifacts & science)。　From Da-Hseh

Confucianism's perspective

- ## Activeness
  - No school education was addressed but the active responsibility of individuals for the whole society
  - Actively linking science, knowledge, families, society, and the world

- ## Contributing
  - Learning is not simply exploring the logic of simple phenomenon but also solve the complex problems in the world to pursue the benefit of the whole human beings.

Ubiquitous learners & learning minds

- *Personal autonomy*, *Active engagement*, *Personal relevance*
  - Learners perceive and act as they are the owners of learning process, problems, and innovations.
- *Social collaboration*
  - Learners understand the limited individual minds and are willing to collaborate to achieve great work.
- *Epistemic pluralism*
  - Knowledge is not invariables but may be varied and interpreted differently by different people and perspectives.
- Social intelligence
  - Learning is not start from nothing. It could be based on the contribution of someone and individuals could make contribution to the society.

Pedagogical & Environmental Transformation

- The major role of classrooms thus is not to transmit knowledge into students' heads but to
  - (1) transform students into owners of learning and reflective learners
  - (2) encourage students to be owners of innovation and knowledge constructions, and
  - (3) cultivate the mind of collaboration and knowledge sharing to extend personal limited minds and social creativity.

Environmental & Pedagogical Transformation

- Owners of learning process: Are students and teachers encouraged/allowed to exploit their own way to apply technologies?

- Owners of learning process: Do all students and the teachers share the same mind in the learning process in a educational environment?

- Social Collaboration: Does the educational environment orchestrates and engages individual minds in collaborative activities?

- Epistemic pluralism: Do the educational environment and pedagogies allow the existence of multiple perspectives and encourage students to take epistemic action on these perspectives?

- Social Intelligence: Do the educational environment and pedagogies encourages individual minds cooperatively utilize the artifacts available to expand learning and others' contribution?

Environmental and Pedagogical Transformation

Issue	Examples of learning systems	Challenges
Technology adoption	Moodle, Lams	Flexibility, Context-free design
Democracy of learning activity	Scribbles, Clicker	Engagement, Self-relevance,
Learners as Contributors	Blog, Wikis, Knowledge Forum	Contributions are credited and appreciated
Collaboration and Social Intelligence	Wikis, Collaborative Filtering Systems	Boundary objects, Connection tools

Technology adoption

- *The technology designers conjecture how technologies may benefits learning based on existing pedagogical knowledge.*

- *"In classrooms, the programs … are used in different ways, depending on teachers. Some educators use the software as a supplemental tool to drill students in particular lessons; others use it instead of textbooks to teach entire lessons."*

- A context-free software approach

Context-free vs. context-frozen software

- Context-frozen software: it generally combines many functions together, especially for scoring purposes, to support all spectrum of activities

    – E.g. complicated centralized database, fixed context of application, multi-functions
    – High entrance barriers, high cost to be adapted to fit new context

- Context-free software: It contains a simple and general functions to support a basic cognitive activity that constitutes various complex activities.
    – The usage and context of applying the software is left to be decided by users.
    – Eg. editing tools, knowledge organization tools, sharing tools
    – East to be adopted in a new context and combined with other tools

Democracy of learning activity

- ## The classroom computing environment empowers the students to decide partially
  - (1) the learning activity and
  - (2) the context to apply technologies rather than by the technology designer.

  - Engagement: Increasing the sense of self-relevance

  - Learning how to learn: envisioning teachers and students the pedagogical and technological knowledge that help create active and interactive learning experience with handheld devices

Learners as Contributors

- Why people enjoy the community sharing activities like potlucks and hotpots?

Learners as Contributors

- ## Potluck
  - Any contribution even not home made is appreciated
  - Tasting different food from different families
  - Most confident and unique dishes
  - Participants choose dishes to taste freely based on personal preferences

Learners as Contributors

- Choosing their favorite ingredients
- Sitting around a round table to share other's favorites
- Every ingredient shapes the final soup
- In general, only a public spoon available
- Observing others' cooking, or serving others the cooked ingredients

Learners as Contributors

- Learning and creating are not a solitary thinking process or a process starting from nothing but basing on contributions of others.

- Why the contributing & sharing activities like potluck and hotpot are quite rare in our educational environment?

- A learning environment in which Learners believe their contribution (either hand made or being found somewhere) will be credited and understand that active epistemic action on others' contribution is necessary to create new contribution.

Collaboration and Social Intelligence

- The amount of knowledge is doubling every 18 months. (American Society of Training and Documentation)

- Learners or people today face more complex problems without well-known answers (design of pedagogical activity, OLPC, global warming, environmental conservation) which often require creative and broad perspectives to solve them.

Collaboration and Social Intelligence

- Connectivism: **A Learning Theory for the Digital Age** (George Siemens, 2004)

    - *"Chaos is a new reality for knowledge workers. Chaos is the breakdown of predictability"*

    - *"Learning can reside outside of ourselves, and is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing."*

Connectivism and Constructivism

	Constructivism	Connectivism
Learning	Sense making	Connecting complex relationship between information
Domain	Science, Mathematics etc.	Decision making, Creative work etc.
Time to learn	Breakdown when encountering a new phenomenon	Breakdown in Chaos
Innovation	Constructing knowledge by learners	Connecting existing (but new to the learner) knowledge and creating innovation
Cognitive demand	Cognitive conflict and resolution	Evaluation & integration of existing nodes and creating innovation

Some experience and Developing Systems

- Collaborative classroom with handhelds
- Self-organized exploration in physics lab
- CELL : Contributing, Exchange, Linking for Learning (Potluck, Hotpot)
- Collaborative story creation, sharing and telling
- Pedagogical design in classrooms

Collaborative classroom with handhelds

– Private workspace: PDAs, Tablet PCs and Wireless network

– Boundary objects: Display, Workspace
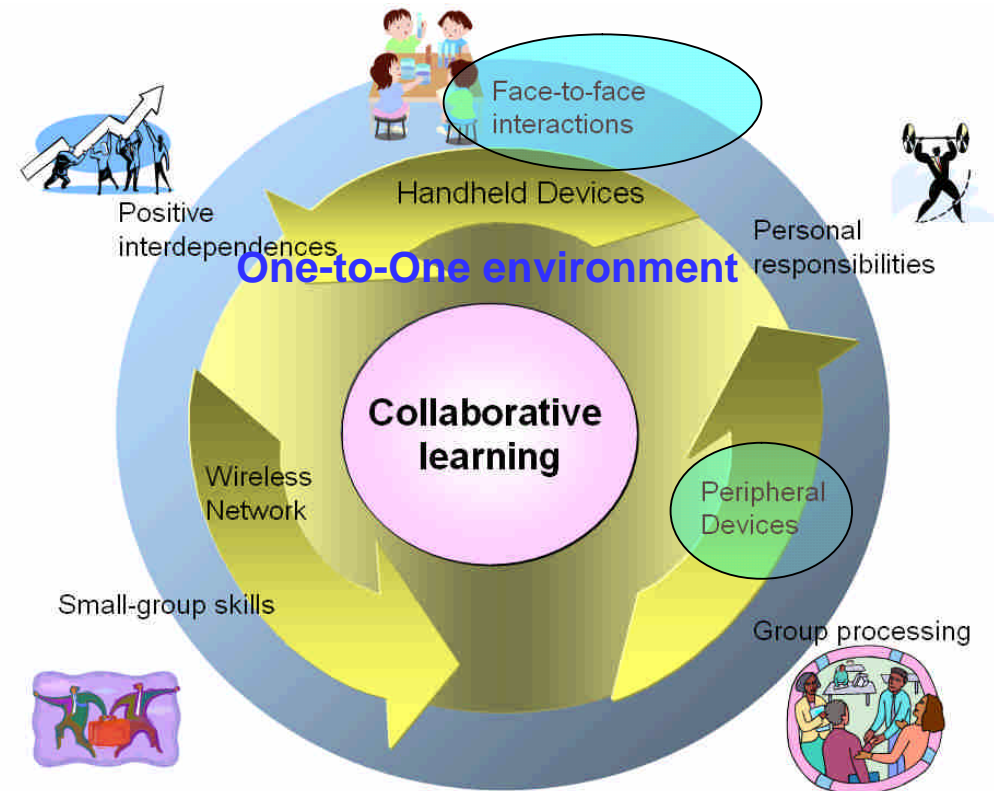
Social Collaboration with Handheld Devices

- The screens of handheld devices, being designed for individual-user mobile application, limit promotive interaction among groups of learners.
- The lack of shared displays may lead to loss of eye-contact and unawareness of visual focus. (by Scott et al. 2004)
  - Students can not conveniently share information and discuss with non-adjacent partners.

Social Collaboration with Handheld Devices

– Communication Ratio
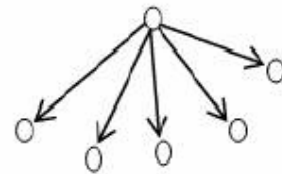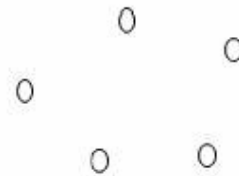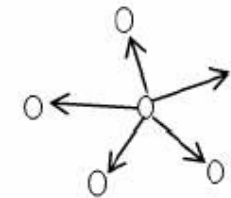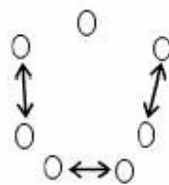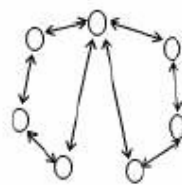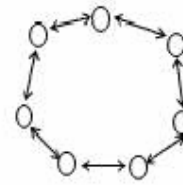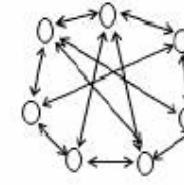
Milson's group communication patterns (1973)

Collaborative Learning Scenario with Shared Display

- The classroom contains six workspaces.
- Each group workspace was equipped with a LCD shared displays.
- Students can freely move to a workspace and login the shared display groupware at the workspace.
- Students not only work within their handheld devices but also share individual contributions with others using shared display groupware.
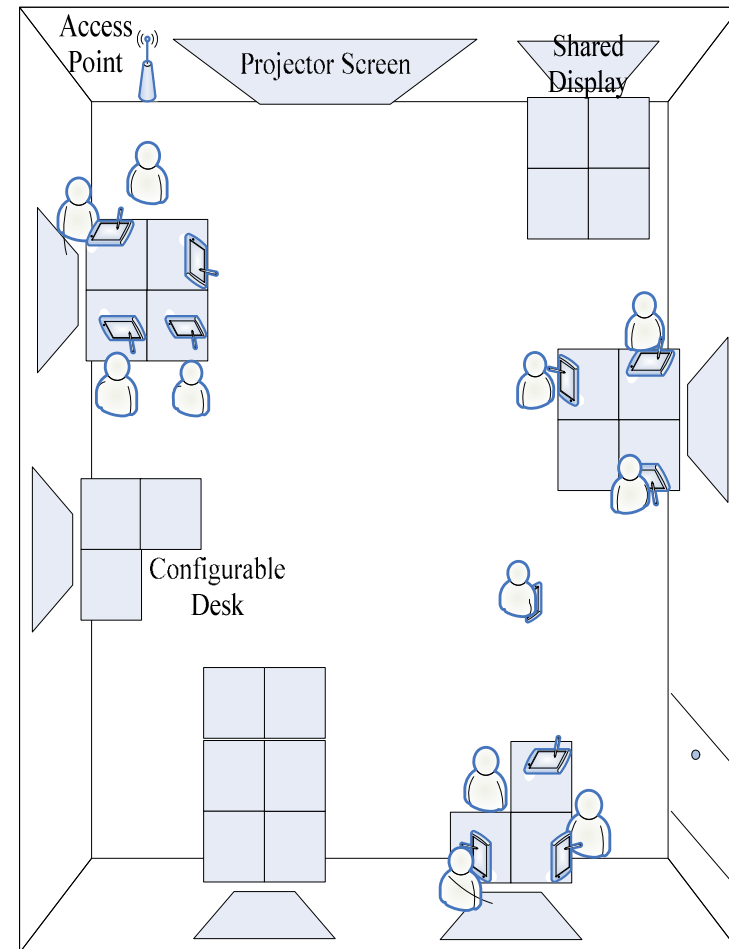
The Shared Display Groupware

The sharing activity with shared display groupware
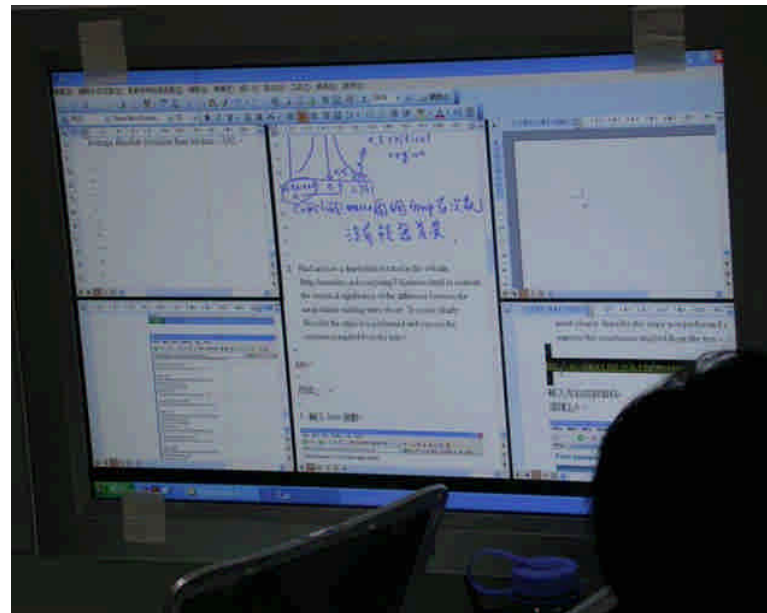
Self-organized collaborative exploration in physics lab

Self-organized collaborative exploration in physics labs

實驗課前活動

Self-organized collaborative exploration in physics lab

1 簡短討論：老師在實驗開始前，先針對學生事先上傳的預報作業進行討論，來彌補學生對於實驗內容之先備知識較不足的部份

Exploration outline

實驗課中活動

2 檢視預報：小組成員
他組員預報，並且組員
驗

1. Collaborative review of exploration plan with PDAs,
2. Reaching a unified exploration plan
3. Act as planned (responsibility)
4. Dynamically revise the plan
5. PDA as data gathering tools based on the organized plan

1. Rough report Generation by PDAs
2. Discussion
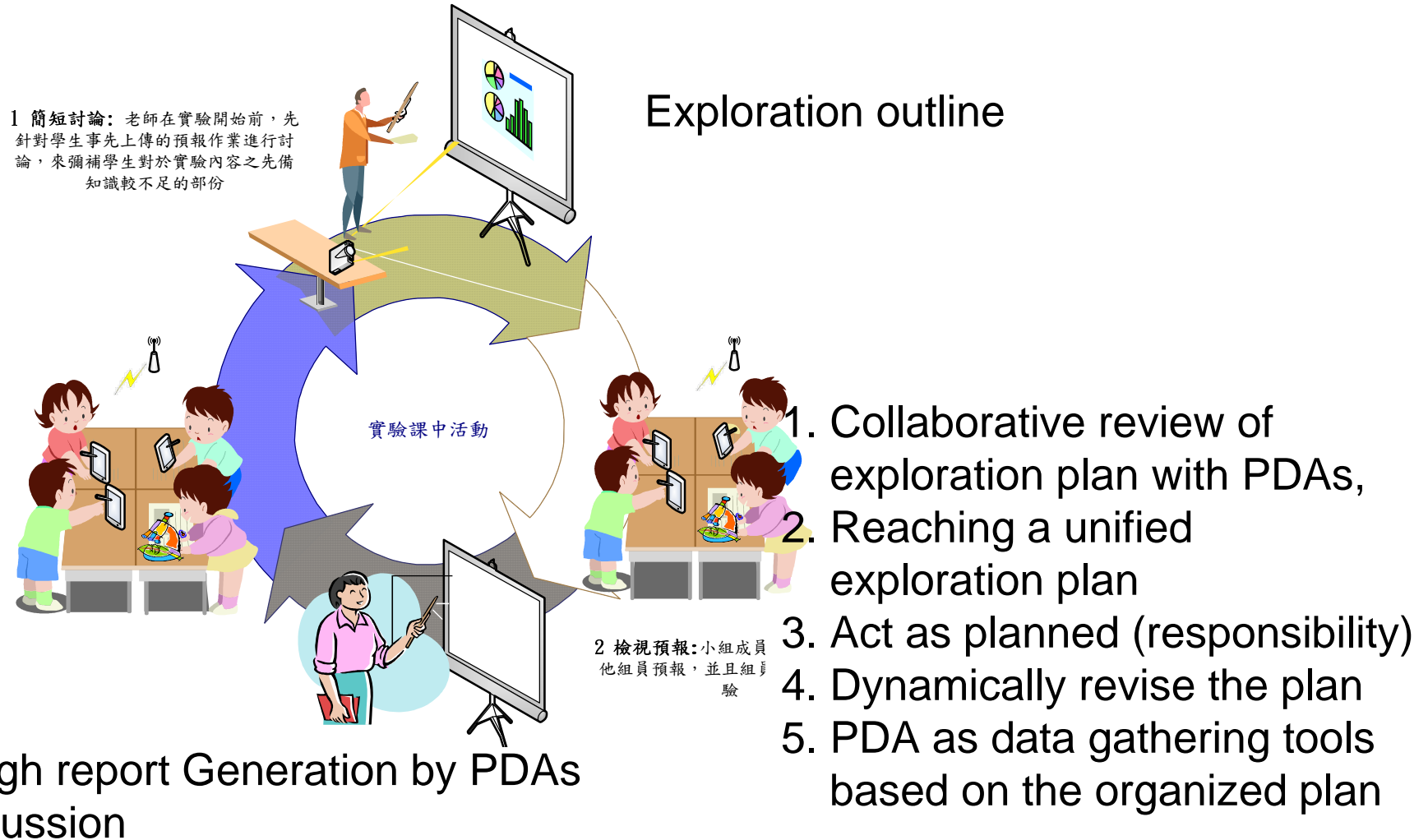
Self-organized exploration in physics lab

CELL: Contributing, Exchange, Linking for Learning (Potluck)

CELL: Contributing, Exchange, Linking for Learning (Hotpot)

CELL: Contributing, Exchange, Linking for Learning

- Contributing, exchanging and linking personal artifacts
- A connection tool:
  - Expanding individual minds by connecting artifacts contributed
  - Expanding group minds by Machine-learning on online resources
  - Expanding group minds by incorporating online resources (Flickr, open music etc.)
- Context-free software
  - Save as files rather than any database format

CELL -- Hotpot

- A synchronous collaborative editing model
  - Contributing, exchanging and linking personal artifacts
  - Collaboration starts from sharing artifacts
  - Contributing ➔Sharing ➔ Creating and linking
  - Individual contributions are visualized in terms of both artifacts and editing efforts contributed.
  - Attributing credits to the existing artifacts by visualizing the relationship of the editing work and these artifacts

Collaborative story creation, sharing and telling

- Most stories live in only story books or in the mind of the person who tells it.

Died in 1998
(aged 89)

Died in 2007
(aged 107)
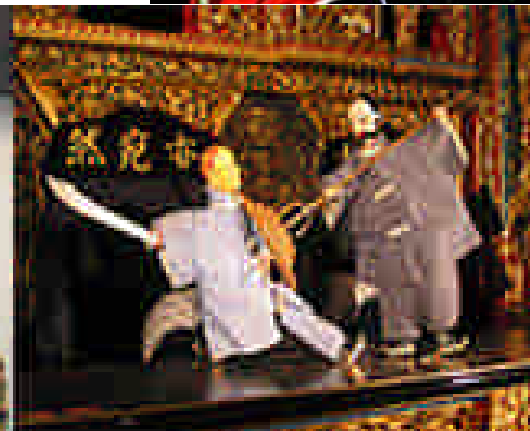
Collaborative story creation, sharing and telling

- Making stories to be created, shared, and presented in a lively way.
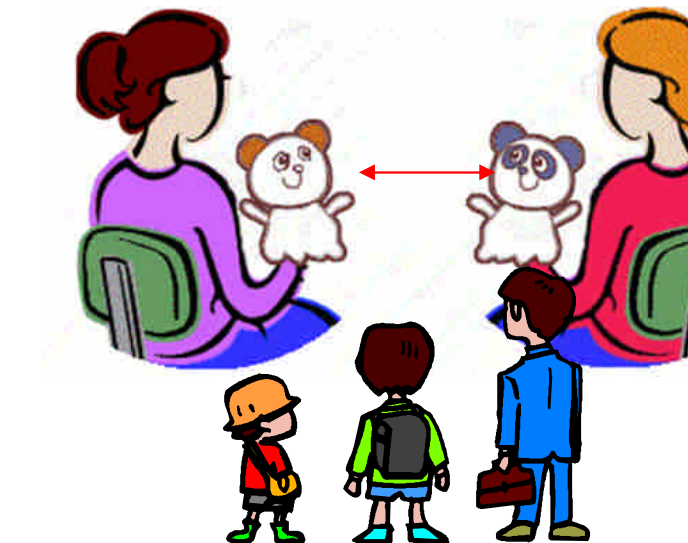
Storytelling puppet

Microphone

Audio Recording

Speaker

Gesture Sensor Glove
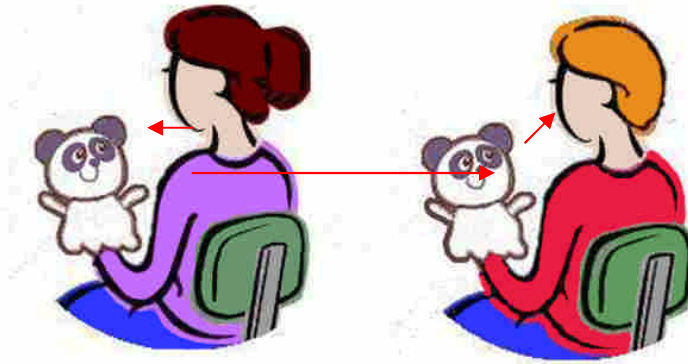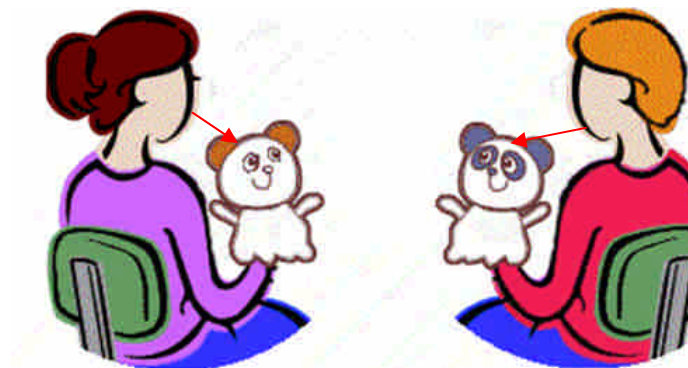
Story Sharing

Collaborative Story Creation

Collaborative Story Telling

Collaborative story creation, sharing and telling

- Supporting the creation process
  - Social scaffold: Linking more creative minds by contributing, exchanging and linking personal creations
  - Affective scaffold: Multiple storytelling devices (Computer, Mp3 player, or puppets), sense of ownership
  - Structural scaffolding: story framework in different detail level from abstract to specific
  - Technical scaffolding: Multimedia processing (mixing background sounds and images, voice recording, or text)

Envisioning, Empowering, and Reflection – A design model for Technology-Enhanced Learning

- Envisioning: Repository of pedagogical knowledge

- Empowering: Context free software and conceptual view of technologies (Pedagogy view, activity pattern, and technological tools) with EDC

- Reflection: Collaborative review with activity videos on EDC.

PedaDesign

Pedagogy Setting

ConceptMap

WordLog

Cell

SequenceEdit

PA CM

CM
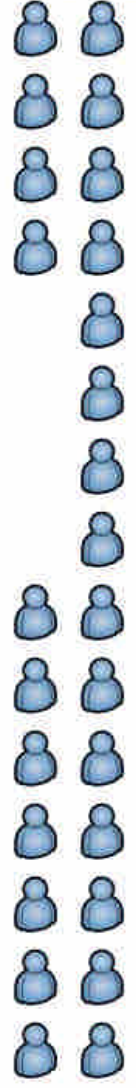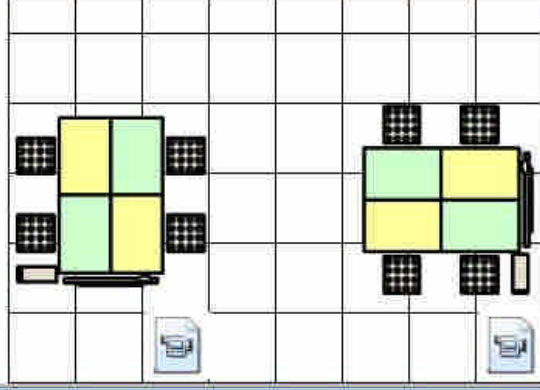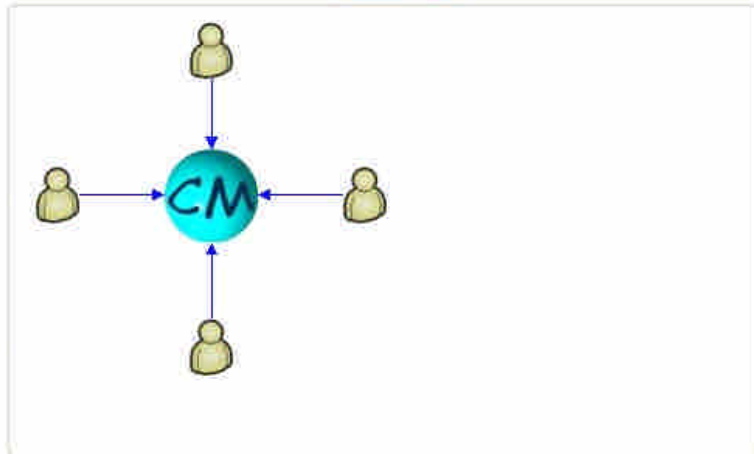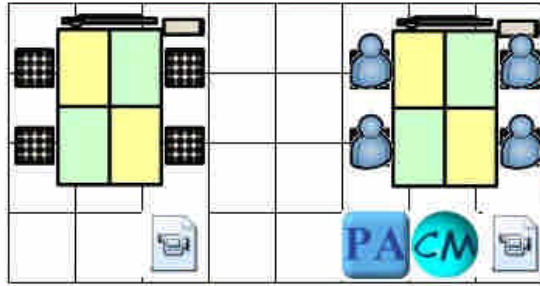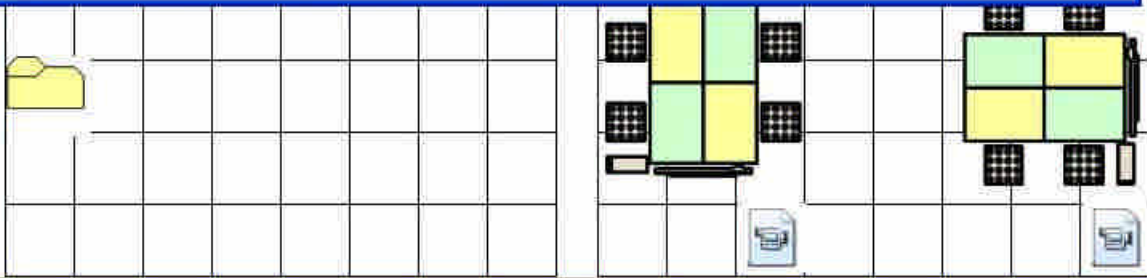
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Thanks!

Brief history review of TEL

Learner-Centered Education

Donald A. Norman and James C. Spohrer

LEARNER-CENTERED DESIGN
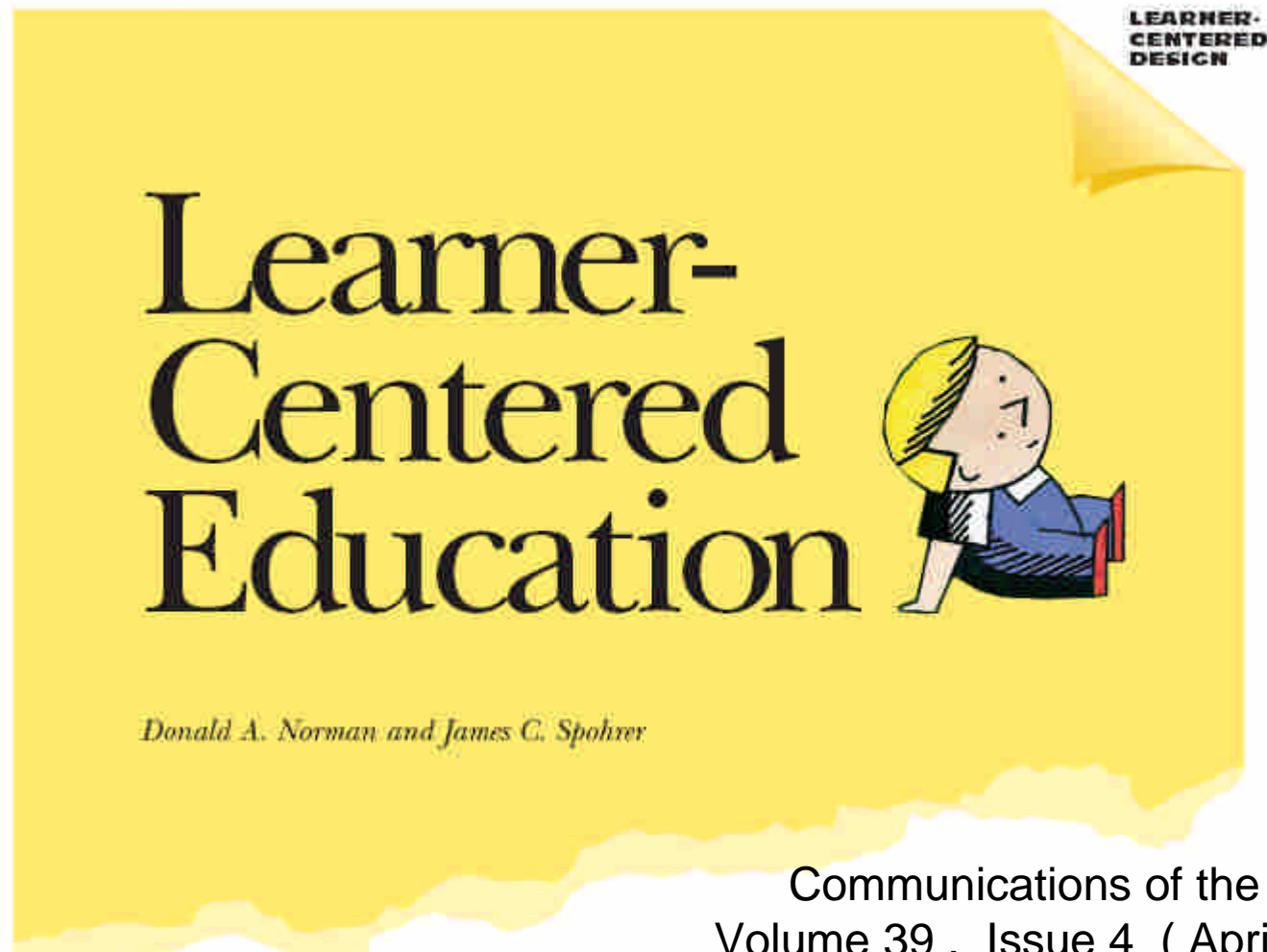
Communications of the ACM
Volume 39 , Issue 4 (April 1996)

Brief history review of TEL

- Evaluation of educational software: Engaging, Effectiveness and Viability (adoption)
    - Knowledge forum (Scardamalia & Bereiter): Engaging by collaboration
    - WISE (Marcia Linn): Engaging by multimedia
    - Lifelong Learning (Gerhard Fischer): Engaging by real problems
    - Collaboratory Notebook (Roy Pea): Engaging by collaboration
    - Complex problem learning (Janet Kolodner): Engaging by real problems

Brief history review of TEL

- Clicker: engaging & viable
- Engaging
  - Quick response
  - Everyone's the contributor and the shaper of collective thinking
- Viable
  - being fit to the scenarios of everyday learning in classrooms

Learner Centered Education

- Group Scribbles: engaging & viable
- Engaging
  - Collaborative and interactive
  - Everyone's the contributor of collective thinking
- Viable
  - Democracy of learning activity
  - Flexibility
  - Enforcing no strict activity structure