



Center for  
**LifeLong  
Learning  
& Design**

University of Colorado at Boulder

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

## Massively Open Online Courses (MOOCs) as Components of Rich Landscapes of Learning

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Academia Europaea & The Wenner-Gren Foundations Conference: “Emerging Models of Learning  
and Teaching in Higher Education: From Books to MOOCs?”, Stockholm, May 22, 2015

# Massive, Open, Online Courses (MOOCs)

- **many of the reflections about MOOCs** are based on
  - **economic perspectives** (scalability, productivity, being “free”)
  - **technology perspectives** (platforms supporting large number of students in online environments, enrichment components such as forums, peer-to-peer learning support, automatic grading, .....)
  
- **our research objective:** to create a **learning science perspective** by putting MOOCs into a larger context with other approaches to learning and education
  - **rich landscapes / ecologies of learning**
    - not **replacing** other approaches
    - but **complementing** other approaches
  
- **our focus:**
  - not only “**internal**” aspects of MOOCs
  - but “**external**” views as important components of rich landscapes

# Identifying the Truly Limiting Resource

<<source: Herbert Simon “Science of the Artificial”>>

- **major crisis somewhere in the world** → huge numbers of messages arriving at the US state / defense department
- **problem perceived**: printers too slow to print them all (with lots of data collected)
  - **solution**: develop or buy faster printers
- **the real problem**: analyzing / digesting / acting upon all the information printed
  - **solution**: .....

# My Background and Beliefs: Center for Lifelong Learning & Design (L3D) at CU Boulder

- **fundamental design challenges**

- **have** to learn → **want** to learn
- teacher, learner = **f{person}** → teacher, learner = **f{context}**

- **schools, universities, courses, .... are social constructs — they do not exist in nature**

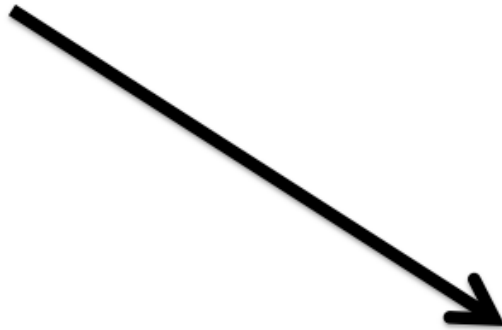
- **teaching and learning are not inherently linked**

- there is a lot of **learning without teaching**
- there is a lot of **teaching without learning**

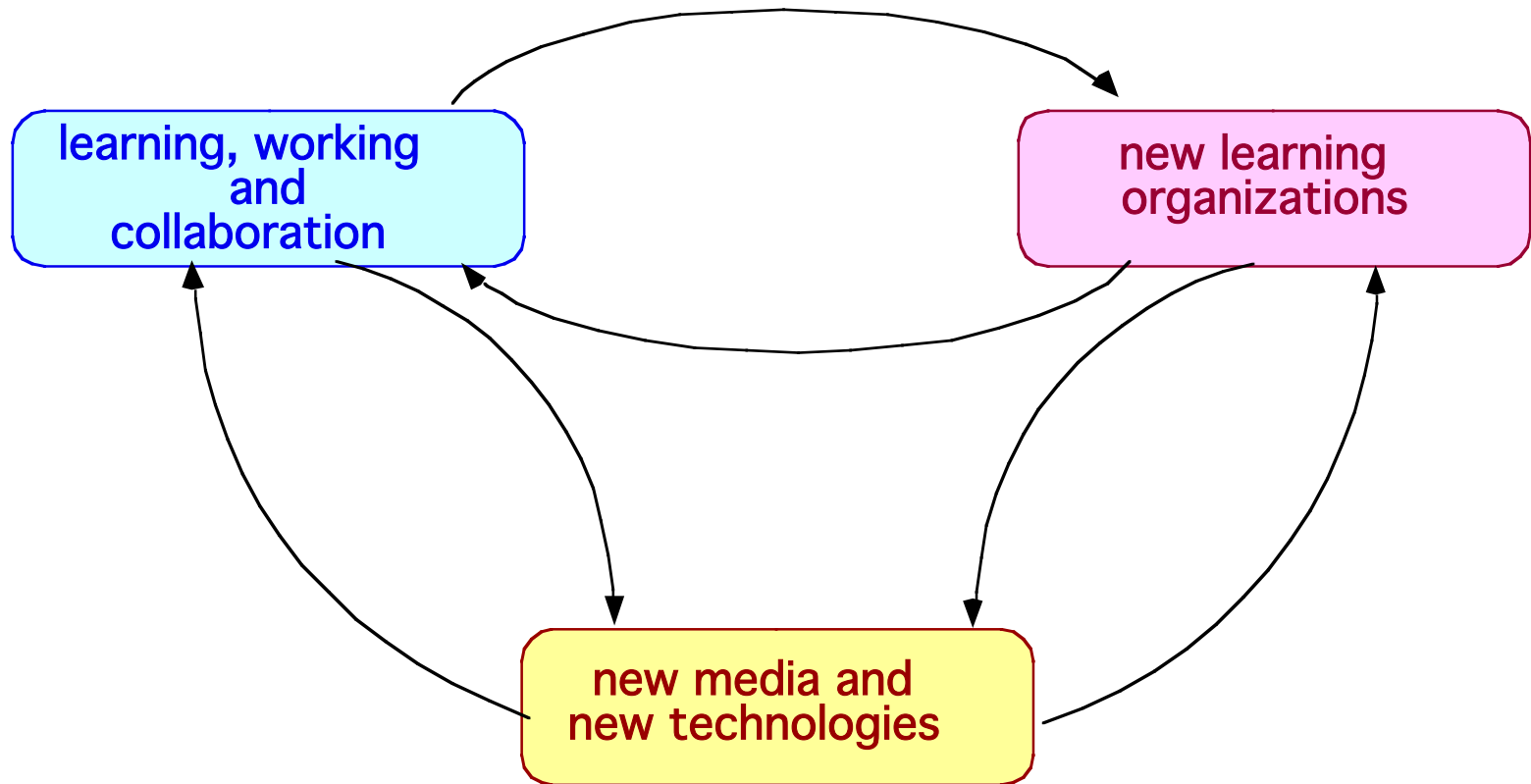
# From Books to Digital Media (Laptops, Smartphones, Tabletops)



# From Books to MOOCs



# Co-Evolution between Learning, New Media, and New Learning Organizations



# MOOCs: **Stuck** in “Gift-Wrapping” or **Moving Beyond**

<<see remarks from Lori Breslow>>

- **stuck** in “gift-wrapping”

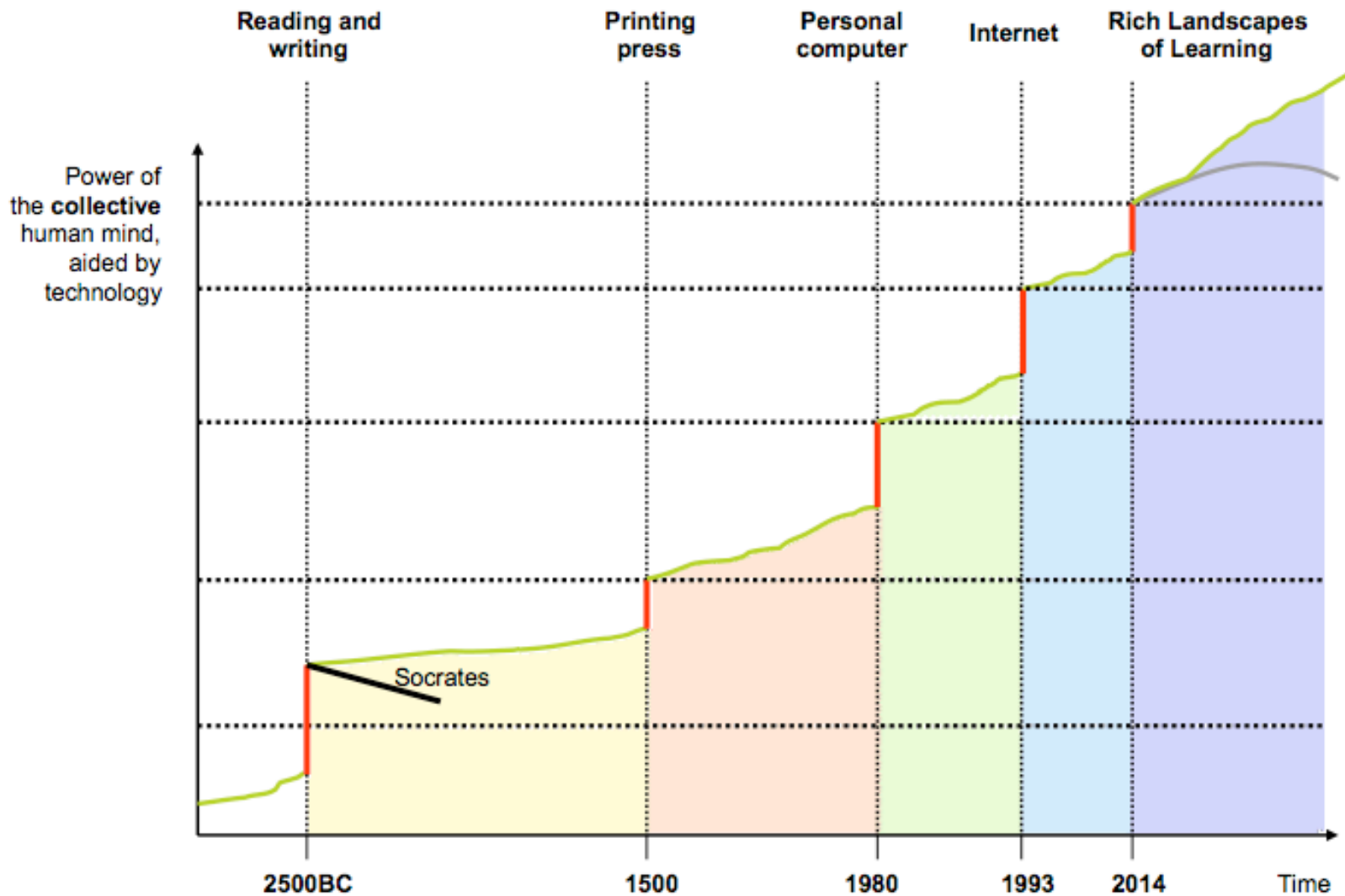
- the same courses taught over the Internet that are taught in residential universities?
- “**moocifying courses**” — the underlying rationale: every first generation technology is a copy of the old medium

- **moving beyond** “gift-wrapping” to co-evolution:

- “distance learning is different from classroom learning at a distance”
- MOOCs = text book of the 21<sup>st</sup> century
- MOOCs = support “flipped classroom” approaches
- commoditizing the ‘content’ sharpens the focus on the substantive values of residential education



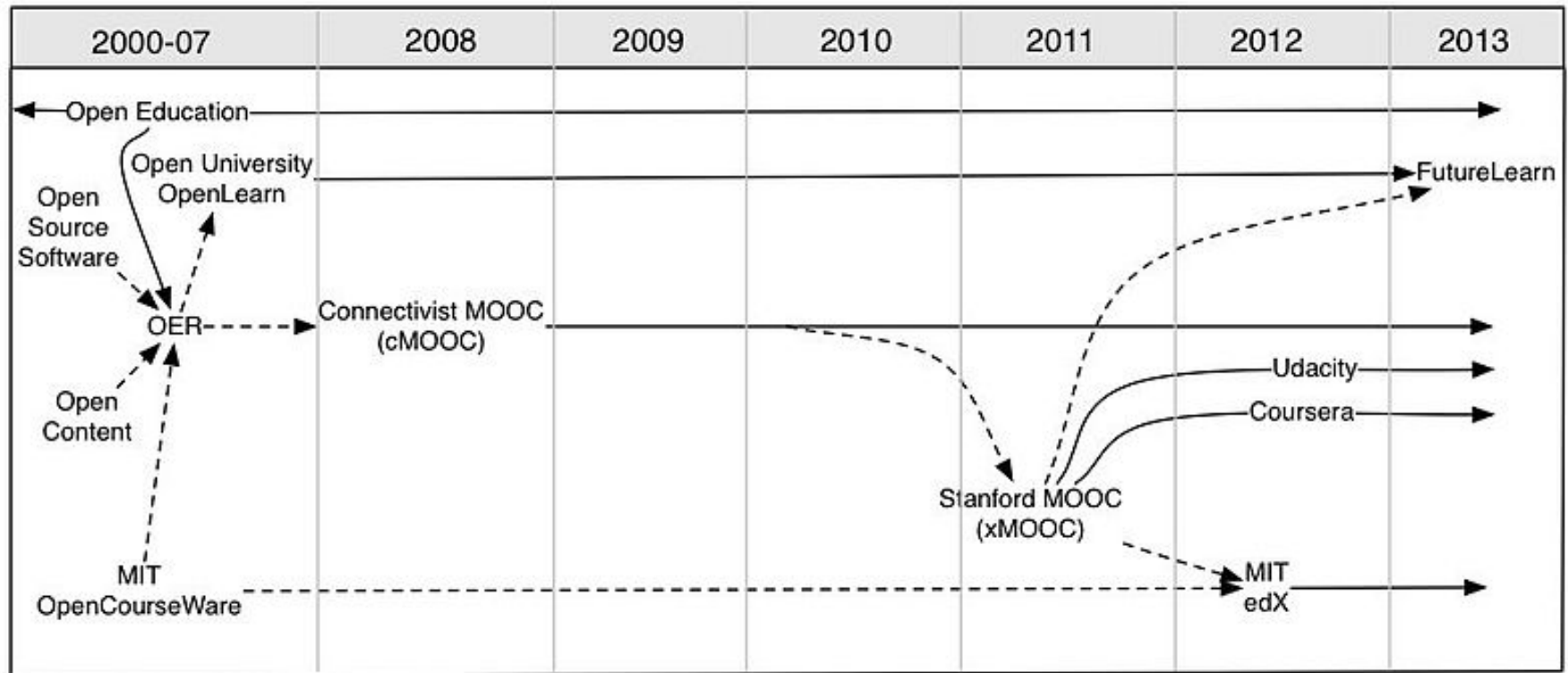
# Beyond the Unaided, Individual Human Mind



## Two Basic Visions and Paradigms <as early as 1970>

computer teaches the learner	learner teaches the computer
instructionism (B.F. Skinner)	constructionism (Jean Piaget)
programmed instruction	programming (in LOGO - Seymour Papert; Smalltalk - Alan Kay)
computer-assisted instruction (CAI; Patrick Suppes)	computational thinking
intelligent tutoring systems (ITS); cognitive tutors (e.g.: PACT Center at CMU)	interactive learning environments (ILE); e.g.: Scratch, Agentsheets, Maker cultures
curricula, MOOCs	digital literacy (“independence of high-tech scribes”)
<i>learning science topics: coverage, coherence, personalization (via user models)</i>	<i>learning science topics: learning by doing, self-directed learning, problem-based learning</i>

# Ancestors of MOOCs



- - - - -> An influence  
 —————> Directly related

<< source: Yuan, Li, and Stephen Powell. MOOCs and Open Education: Implications for Higher Education White Paper. University of Bolton: CETIS, 2013. <http://publications.cetis.ac.uk/2013/667>>>

# Massive, Open, Online Courses (MOOCs)

## The Promises of MOOCs

- courses from the top universities
- learn from world-class professors
- watch high quality lectures
- achieve mastery via interactive exercises
- collaborate with a global community of students
- being free

# The Hype: MOOCs will Revolutionize Higher Education

- **edX:** “most important educational technology in 200 years”
- **John Hennessey** (President, Stanford University): “there’s a tsunami coming”
- **NY Times:** “2012: the year of the MOOC”
- **Scientific America:** “Technology is remaking every aspect of education, bringing top-notch courses to the world's poorest citizens and reshaping the way all students learn” (<http://www.scientificamerican.com/editorial/digital-education/>)

# The Underestimation of MOOCs

- **Vardi in CACM (2012):**

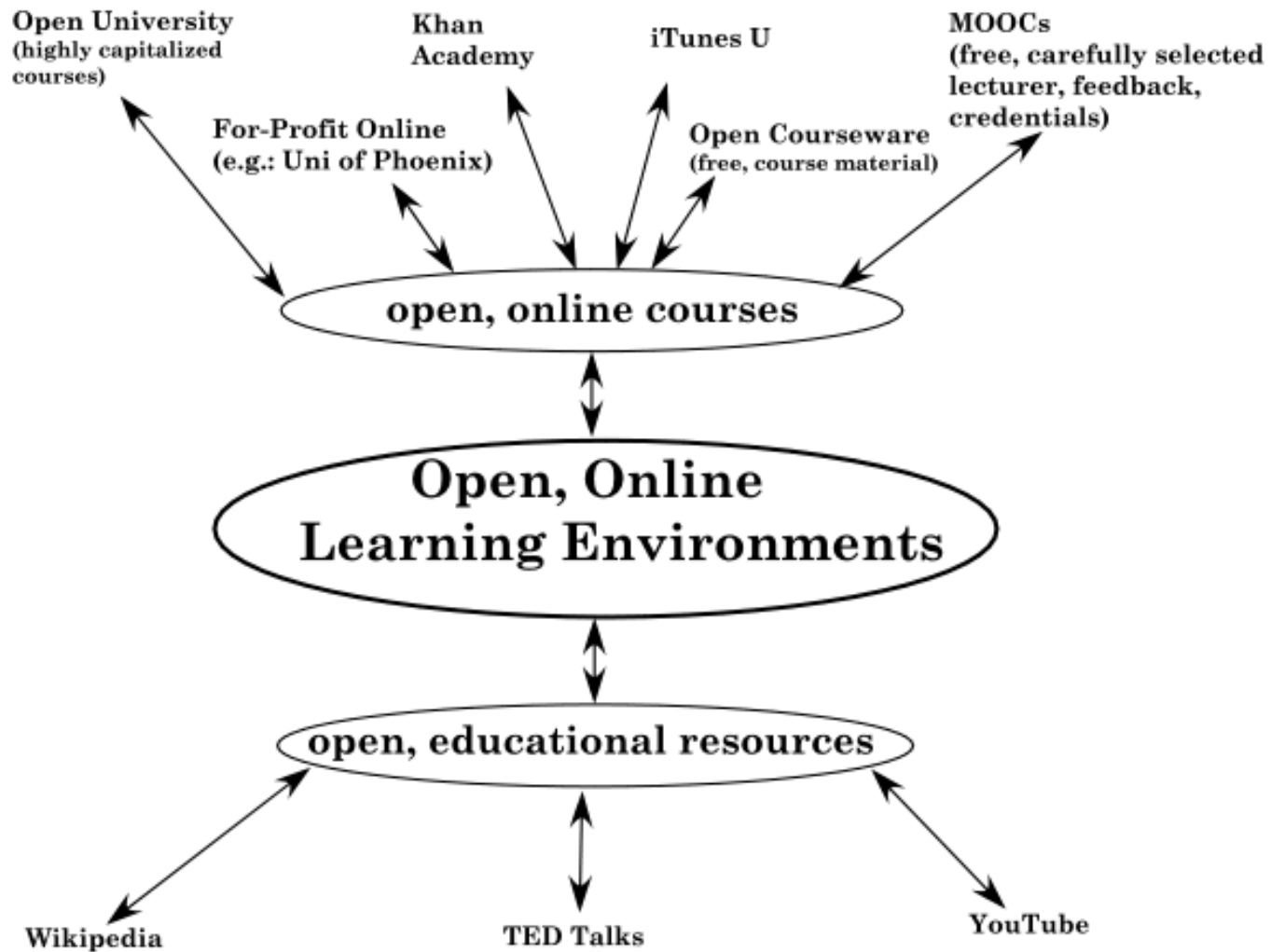
- *“the absence of serious pedagogy in MOOCs is rather striking, their essential feature being short, unsophisticated video chunks, interleaved with online quizzes, and accompanied by social networking.” .....*
- *“If I had my wish, I would wave a wand and make MOOCs disappear, but I am afraid that we have let the genie out of the bottle.”*

- **Sebastian Thrun:** *“Udacity’s courses are often a “lousy product.”*

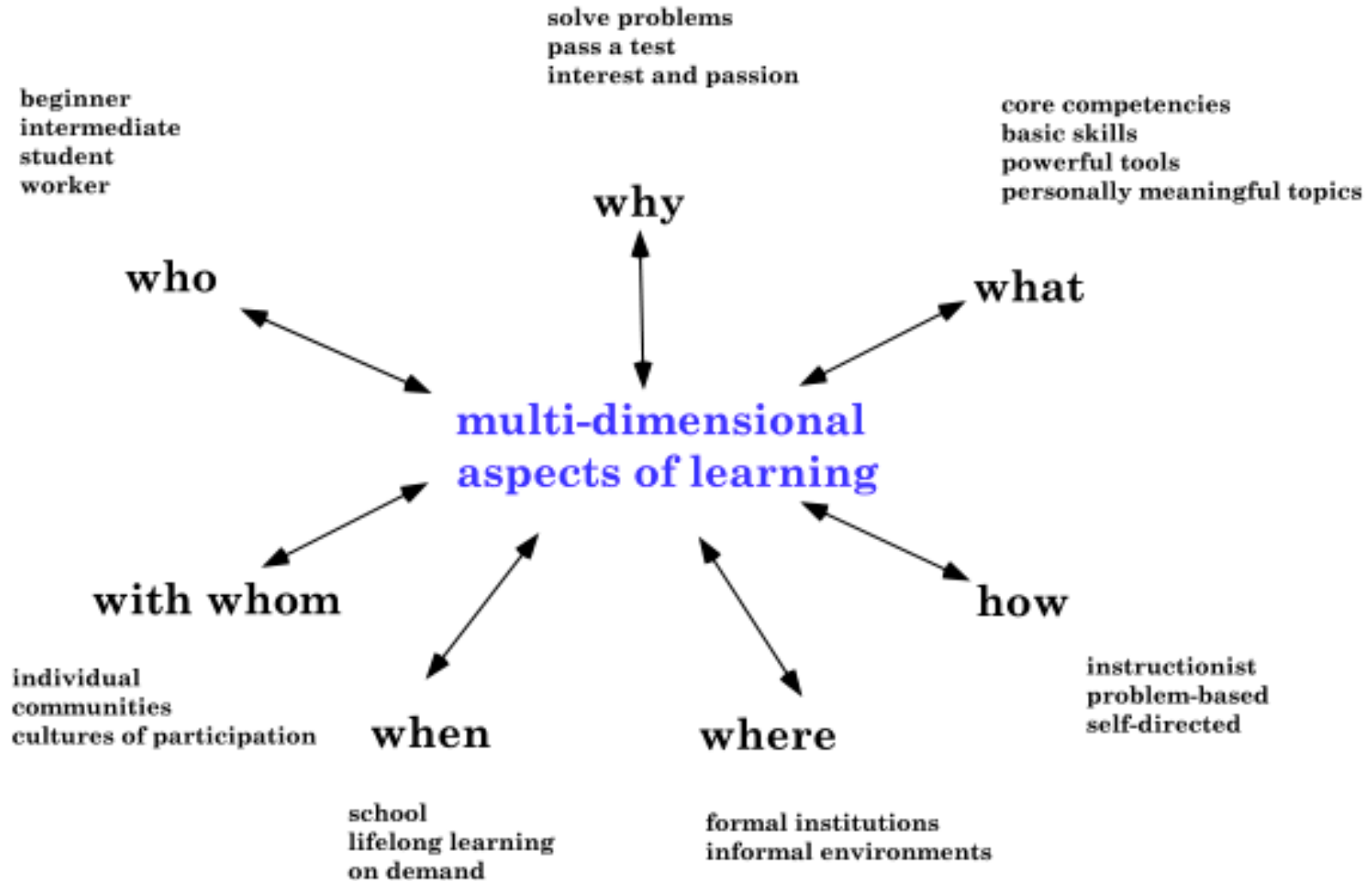
- *“Udacity's Sebastian Thrun, Godfather Of Free Online Education, Changes Course” — <http://www.fastcompany.com/3021473/udacity-sebastian-thrun-uphill-climb>*
- *“The King of MOOCs Abdicates the Thron: Sebastian Thrun and Udacity’s “pivot” toward corporate training” — [http://www.slate.com/articles/life/education/2013/11/sebastian\\_thrun\\_and\\_udacity\\_distance\\_learning\\_is\\_unsuccessful\\_for\\_most\\_students.html](http://www.slate.com/articles/life/education/2013/11/sebastian_thrun_and_udacity_distance_learning_is_unsuccessful_for_most_students.html)*

<<**source:** Fischer, G. (2014) "Beyond Hype and Underestimation: Identifying Research Challenges for the Future of MOOCs," Commentary for a Special Issue “MOOCs: Emerging Research”, Distance Education Journal>>

# MOOCs in the Context of Open, Online Learning Environments

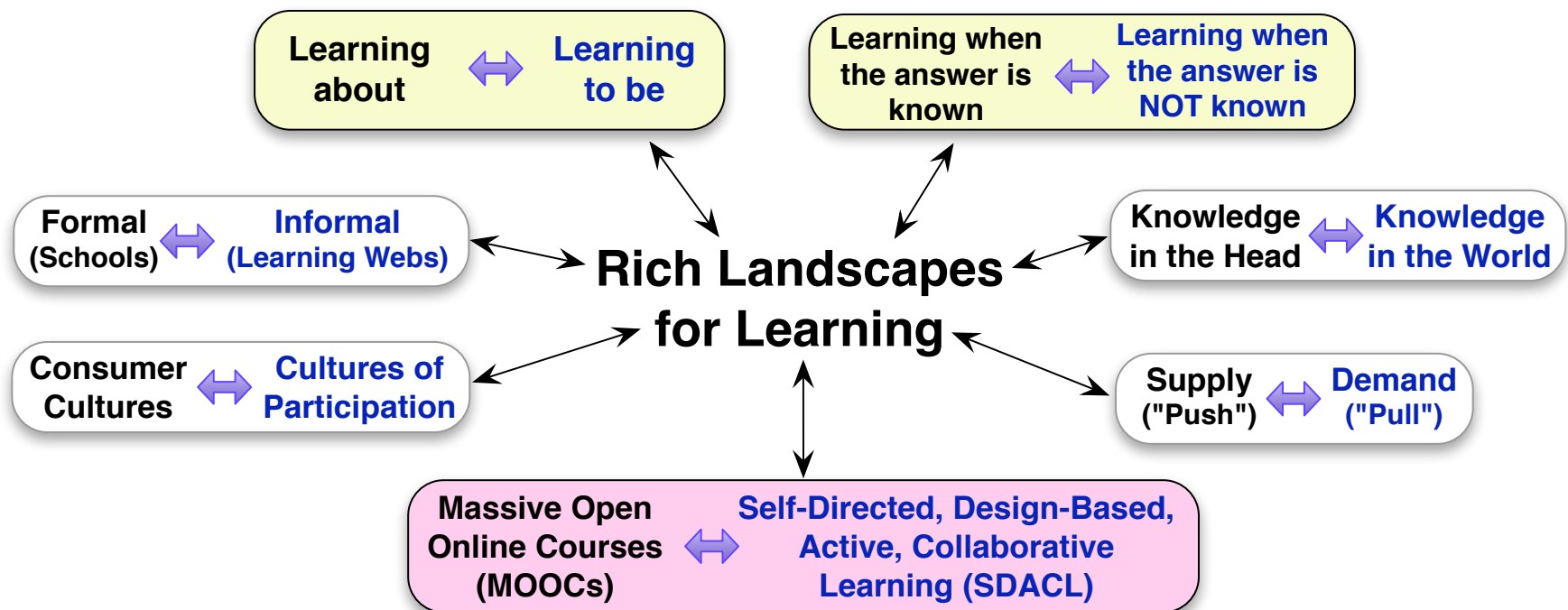


# Rich Landscapes for Learning





# Different Dimensions and Objectives Defining Rich Landscapes for Learning



# Learning About versus Learning to Be

## ▪ learning about:

- focused on the accumulation of intellectual capital realized in a curriculum
- stresses the communication of culturally central theories, facts, and skills
- **claim:** MOOCs can be effective and are often well suited for “learning about” (e.g., learners getting introduced to domains of knowledge that are new to them, e.g., Math 101, Physics 101, Design 101, etc.)

## ▪ learning to be:

- not teaching about mathematics, physics, or design → but: what it means to be a mathematician, a physicist, a designer, a “Wikipedian,” a skier, or a surfer
- putting students in touch with communities, not only with information
- in our Center for Lifelong Learning & Design (L3D):
  - Undergraduate Research Apprenticeship Program
  - horizontal and vertical integration (Discovery Learning Initiative and Center)

# Learning When the Answer is Known versus Learning When the Answer is Not Known

- **learning when the answer is known**
  - core challenge: learners should learn what the teacher knows
  - answers to the problems exists (this is the case for many problems in the *natural sciences*: physics, mathematics, ....)
  - the answer is known by the teacher
  
- **learning when the answer is not known**
  - core challenge: all participants engage in collaborative knowledge construction
  - a “correct, final answer” does not exist (this is the case for many problems in the *sciences of the artificial*: design, technology influenced disciplines such as Computer Science)

# The Envisionment and Discovery Collaboratory (EDC)

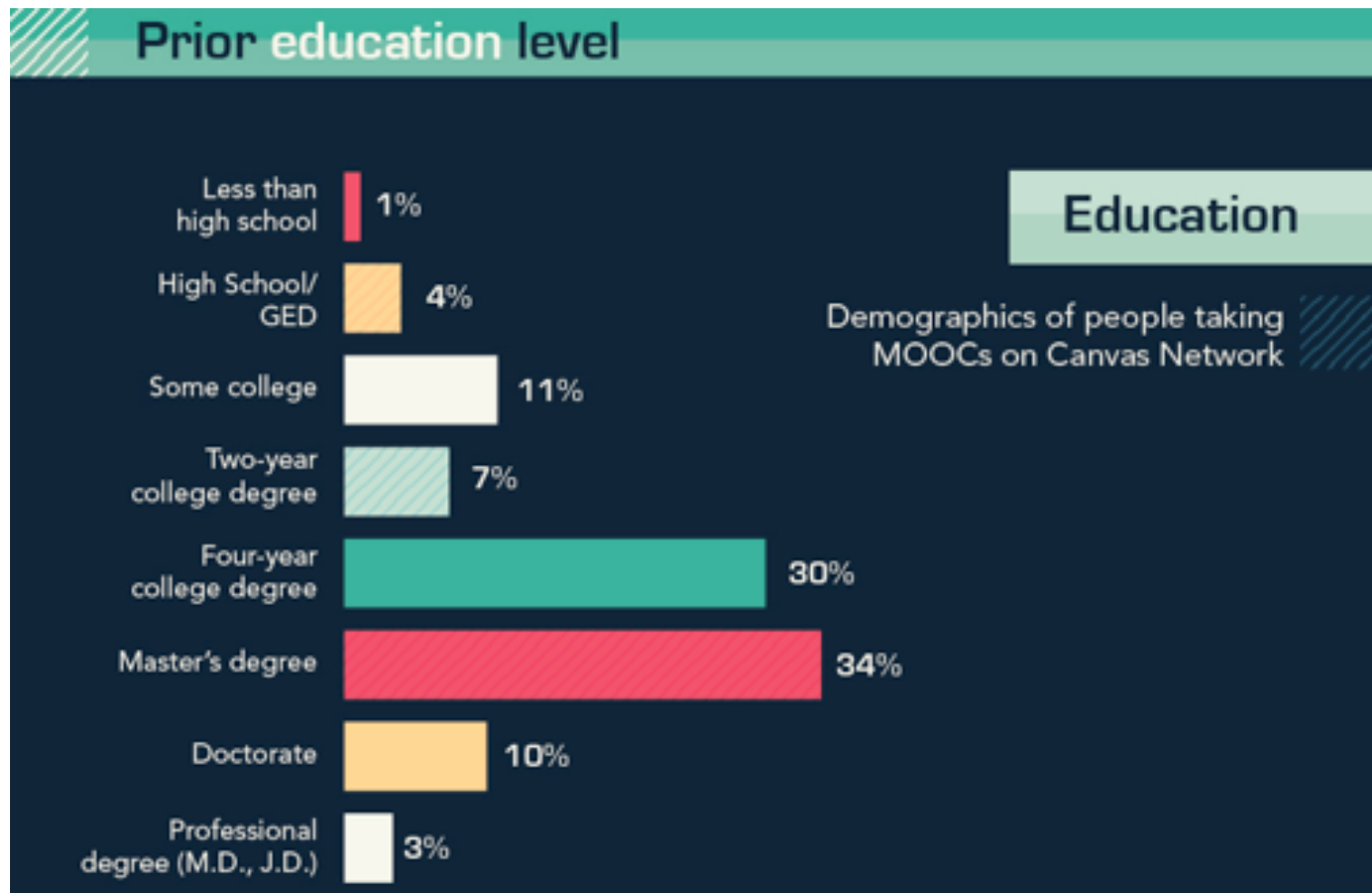


# Open Issues and Questions about MOOCs

- **what kind of different MOOCs exist?**
  - cMOOCs (**c**=**c**onnectionist)
  - xMOOCs (**x**=**eX**tended)
  - SPOCs = **S**elf-**P**aced **O**pen **C**ourses
  - VLRCs = Very Low teacher/student Ratio Courses
  - nanodegree programs (Udacity)
  
- how **interactive** are MOOCs?
  
- for **which type of learning** are MOOCs a good fit?
  
- why are MOOCs (or at least some of them) successful and **what does success mean?**
  
- how are the participants **certified / credentialed?**
  
- will MOOCs eventually make **lectures obsolete?**

# Data about MOOCs

source: <http://ideas.ted.com/2014/01/29/moocs-by-the-numbers-where-are-we-now/>



# A Claim

teaching a class in a residential university with more than 100, 150 or 200 students  
**is not fundamentally different** from a MOOC

- **yes — it is different:**

- students come together in a classroom – they see each other
- teacher sees the students — senses their engagement level
- while not every student can ask a question → some students can
- for the instructor:
  - there are learning opportunities
  - it provides a nicer atmosphere than sitting in a room by herself

- **no — it is not different:**

- a large class remains mostly instructionist
- most students will not have an opportunity to ask a question
- large classes are taught in physically designed instructionist classrooms



## Core Competencies (CCs) of Residential, Research-Based Universities

- CC-1: Allowing and motivating learners to engage in authentic, self-directed learning activities
- CC-2: Supporting Active Knowledge Construction
- CC-3: Fostering Enculturation
- CC-4: Framing Problems
- CC-5: Coping with Wicked, Ill-Defined Problems
- CC-6: Grounding Learning in a Distributed Cognition Perspective
- CC-7: Emphasizing Collaborative Learning and Communication Skills
- CC-8: Giving Degrees
- CC-9: Creating Lifelong Relationships between Institutions and Learners



## L3D's Research Agenda to Focus on the Core Competencies of Residential, Research-Based Universities

- **Cultures of Participation** — migrating from passive consumers to active contributors
- **Meta-Design** — fostering and supporting active knowledge construction; transcending the information given
- **Learning-on-Demand** — allowing and motivating learners to engage in authentic, self-directed learning activities
- **Collaborative Design** — “learning when the answer is not known” and transcending the individual human mind
- **Transdisciplinary Collaboration** — to cope with systemic problems
- **Courses-as Seeds** — “flipped classroom”, student as active contributors, peer-to-peer learning, peer assessment, self assessment
- **Undergraduate Research Apprenticeship** — “learning to be”; vertical integration, horizontal integration, fostering enculturation

# Challenge for MOOCs – Local versus Global: The Relevance of Culturally Embedded Knowledge

- courses reaching beyond the borders of individual countries need to explore: how to establish **common ground** and **shared understanding** and how to take locally relevant issues, needs, and understanding into account
- example: in a MOOC about energy sustainability → analyzing and comparing the gas consumption of cars
  - USA
    - miles for distance
    - gallons for gas
    - conceptualization: “a car goes 30 miles per gallon” (fixed amount of gas)
  - Germany
    - kilometers for distance
    - liters for gas
    - conceptualization: “a car needs 7 liters per 100km” (fixed distance)

## Challenge for MOOCs: Do not postulate new learners or teachers

- **Background:** *“the framers of the Constitution did not postulate a new man to be produced by the new institutions but accepted as one of their design constraints the psychological characteristics of men and women as they knew them, their selfishness as well as their common sense.”* — Simon, “The Sciences of the Artificial”
- **Assumption:** **Learning resources are necessary — but they are not sufficient → my claim:** In today's world, most citizens of all ages have substantial learning resources at their disposal— but many do not take advantage of them
- **The big question:** What does and will motivate students and citizens to become engaged to participate in MOOCs and sustain their engagement? What will motivate teachers to offer a MOOC?
- **Our objective:** to create socio-technical environments in which **people want to learn rather than have to learn**

# Challenge for MOOCs — Being “Free”

*“If you think education is expensive, try ignorance”* —  
Derek Bok (former president of Harvard University)

- **Fact:** education is not free in any society. **Basic Services**
  
- **potential business models for MOOCs:** **Premium Services**
  - **certification** — students pay for a badge or certificate
  - **secure assessments** — students pay to have their examinations proctored (Coursera’s Signature Track)
  - **employee recruitment** — companies pay for access to student performance records
  - **human tutoring** and/or **grading** (for which students pay)
  - **selling a MOOC platform** to other companies
  - **sponsorships** (3rd party sponsors of courses)
  - **tuition fees** (Georgia Tech’s Master Degree delivered with MOOCs)
  
- **example** — **“How much does it cost to enroll in a Udacity course?”**
  - All Udacity courses give you free access to our courseware, but for a select number of courses you can enroll in the full course experience. This gives you access to projects, code-review and feedback, a personal coach, and verified certificates.

# Universities: Finding their own Ways

- universities world-wide (administrations, faculty, and supporting organizations) are paying close attention to MOOC developments → they try to establish their own course of action by **choosing between the strategies**:
  - to calculate the risks of **different possible actions**
  - the risks of **doing nothing**
  - many institutions establish MOOCs without exactly knowing why they are doing it (driven by a “**me too**” mindset)
  - for CU: the role of MOOCs for “**Flagship 2030 Vision**”?  
<http://www.colorado.edu/flagship2030/sites/default/files/attached-files/CUFlagship.pdf>
  
- **Georgia Institute of Technology** (in collaboration with Udacity) will offer Master Degrees in Computer Science
  - delivered with MOOCs costing students \$ 6,600
  - regular campus courses costing students \$45,000

# Universities: Finding their own Ways

- **Amherst College: saying “no” to an edX invitation**
  - not for financial reasons
  - but because of “a number of philosophical qualms. MOOCs run counter to Amherst's commitment to learning through close teachers/students interaction”
  - their belief: MOOCs might perpetuate the “information dispensing model of teaching”
  
- **San Jose State University: rejection of the integration of an existing MOOC into the curriculum**
  - *"In spite of our admiration for your (Michael Sandel's) ability to lecture in such an engaging way to such a large audience, we **believe** that having a scholar teach and engage with his or her own students is far superior to having those students watch a video of another scholar engaging his or her students."*

# MOOCs – an Important Topic for Computer Science Research

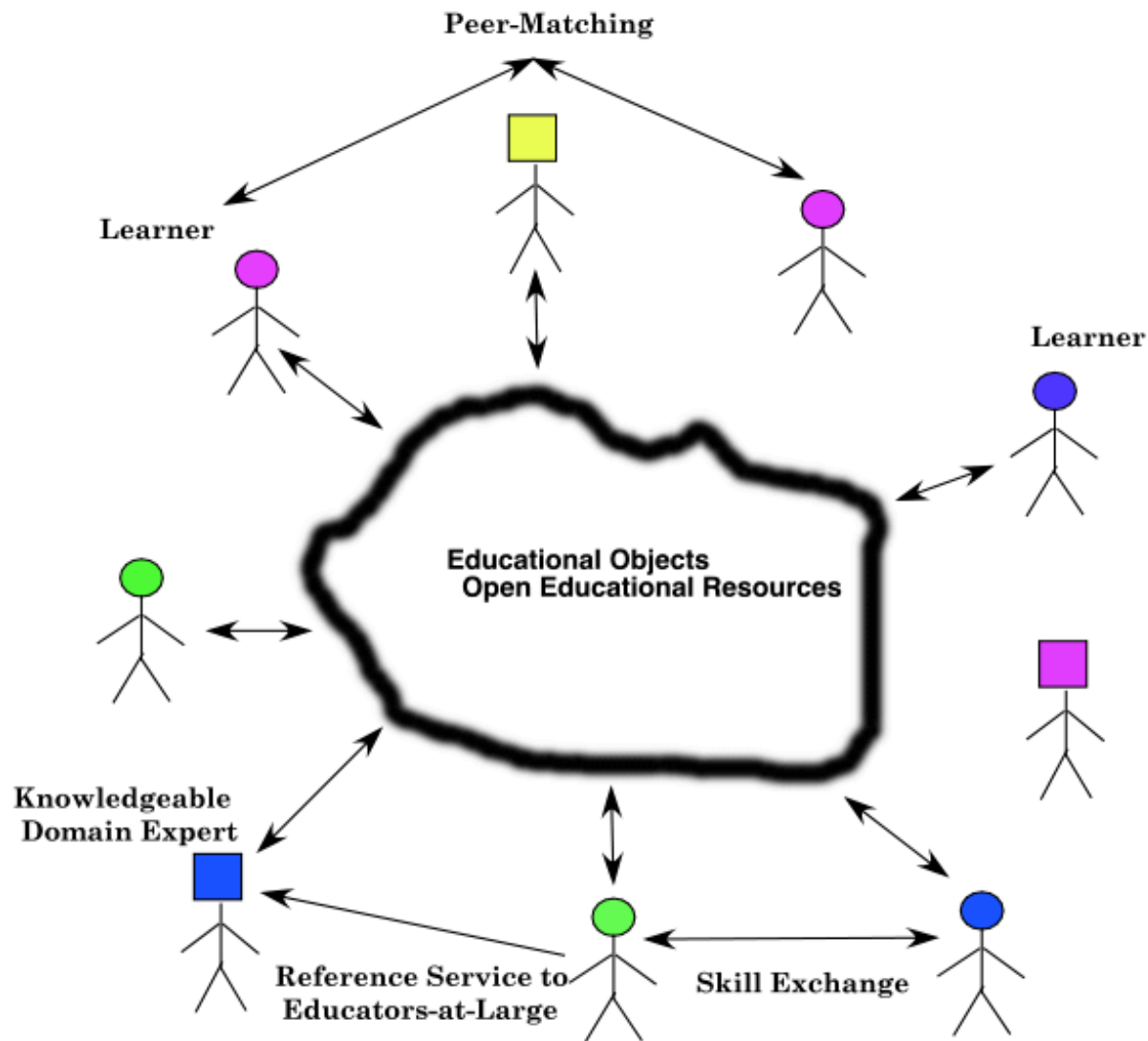
- how could/should we **teach** and **learn** Computer Science?
  - lectures                     $\leftrightarrow$             making / design (e.g.: “Maker Culture”)
  - individual                  $\leftrightarrow$             social (e.g.: “table-top computing environments”)
- how can **platforms** for thousands of participants be improved? → research in **systems**
- how can **personalized and localized representations** be created? → research issues in **end-user development**
- how can **students answers be automatically analyzed** (currently mostly: multiple choice question) → research issues in **natural language processing**
- how can important insights via **learning analytics** be obtained? → research issues in **“Big Data”**

# Contributions of MOOCs

- the core contribution of MOOCs: **M = massive**
- they **generated a discussion** transcending the narrow confines of academic circles by getting the world at large involved and excited
- they represent a development that is **shaking up models of learning and learning institutions**
- they might be able to force residential, research based universities to reflect and focus on their **core competencies**



# Alternative to Reach Large Numbers: Ivan Illich's "Learning Webs" (1971)



# Conclusion

- the future of learning and education in the 21<sup>st</sup> century is not out there to be **discovered** — it has to be **invented and designed** → questions:
  - by pursuing which objectives?
  - by whom?
    - by them? — billionaires and venture capitalists in Silicon Valley
    - by you/us? — faculty members and researchers in learning science, participants of this conference
  
- the major challenge for the **Learning Sciences** in the years to come:

**explore, nurture, and support rich landscapes of learning**

## More Information

- Fischer, G. (2014) "Promises, Limitations and Synergies of Rich Learning Landscapes— Exploring Frames of Reference for MOOCs"  
<http://l3d.cs.colorado.edu/~gerhard/reports/moocs-draft2013.pdf>
- Eisenberg, M. & Fischer, G. (2014) "MOOCs: A Perspective from the Learning Sciences" in J. L. Polman et al. (Eds.), *Learning and Becoming in Practice: 11th International Conference of the Learning Sciences (ICLS) 2014, Boulder*, pp. 190-197.  
<http://l3d.cs.colorado.edu/~gerhard/papers/2014/ICLS-MOOCs.pdf>.
- Siemens, G., Dillenbourg, P., Fischer, G., McNamara, D., & Rummel, N. (2014) "Where Are the Learning Sciences in the MOOC Debate?," *ICLS Conference 2014 (University of Colorado Boulder)*, June 23-27, 2014, pp. 15-17.  
<http://l3d.cs.colorado.edu/~gerhard/papers/2014/ICLS-panel.pdf>
- Fischer, G. (2014) "Beyond Hype and Underestimation: Identifying Research Challenges for the Future of MOOCs," *Commentary for a Special Issue "Massively Open Online Courses (MOOCs)" of the Distance Education Journal*, p. (electronically published: <http://www.tandfonline.com/doi/full/10.1080/01587919.2014.920752>).  
<http://l3d.cs.colorado.edu/~gerhard/papers/2014/distance-ed-journal.pdf>

# Welcome to OnlineConversion.com

## Fuel Consumption Conversion

Convert what quantity?

From:

- liters/100 km
- miles/gallon(US)
- km/gallon(US)
- miles/gallon(UK)
- km/gallon(UK)
- miles/liter

To:

- liters/100 km
- miles/gallon(US)
- km/gallon(US)
- miles/gallon(UK)
- km/gallon(UK)
- miles/liter



»» Convert ««

7 liters/100 km = 33.6020833 miles/gallon(US)

# Distributed Cognition

knowledge in the head



oral societies

+

knowledge in the world



information age



## ▪ **learning science issues:**

- *learning on demand*
- *using on demand*
- *tools for learning*  $\leftrightarrow$  *tools for living*
- *overreliance on external tools*

# Genes and Memes

- **genetic evolution: genes and chromosomes**
  - passed on automatically from one generation to the next
  
- **cultural evolution: memes (the equivalent to “genes”)**
  - memes = units of information
  - a new idea, invention, knowledge is not automatically passed on to the next generation
    - narratives, stories, artifacts
    - myth → historical records → libraries → hard disks
    - schools, universities are social constructs — they do not exist in nature