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

Design, Learning, and Collaboration

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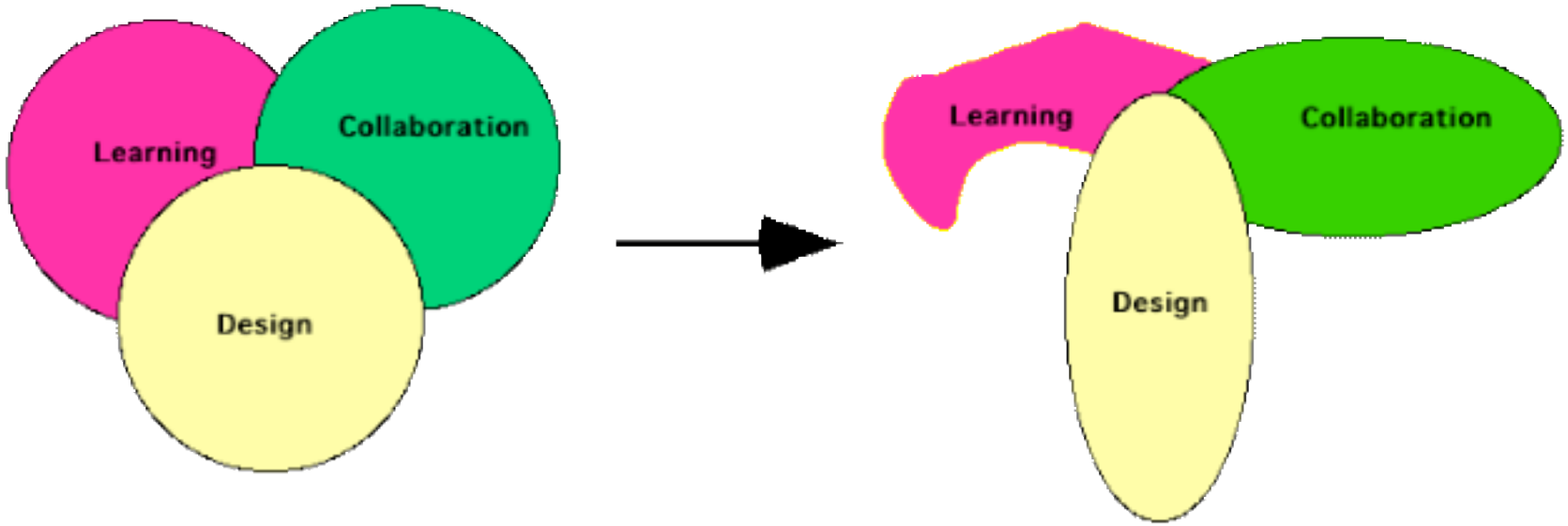
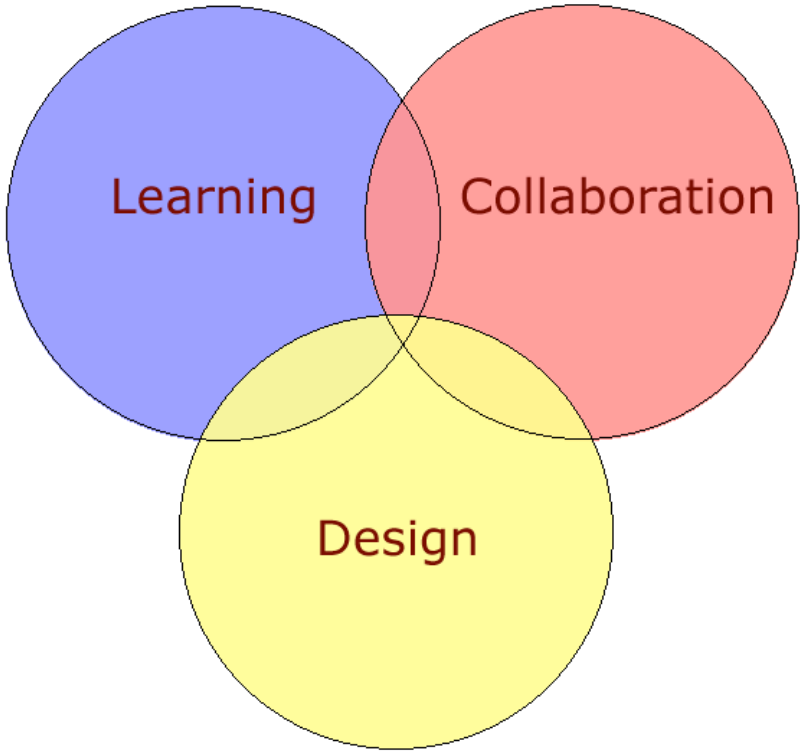
Spring Semester 2004

Introduction and Overview of Course, Jan 12, 2004

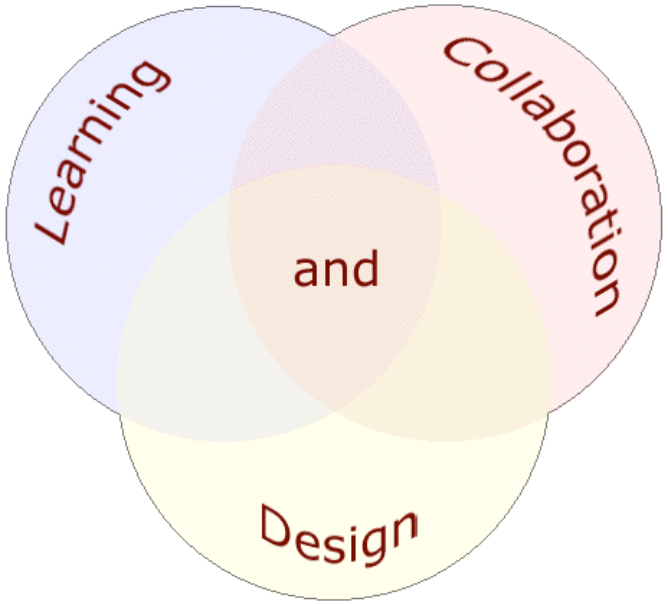
Intersection of Design, Learning and Collaboration and their Changing Nature through New Media



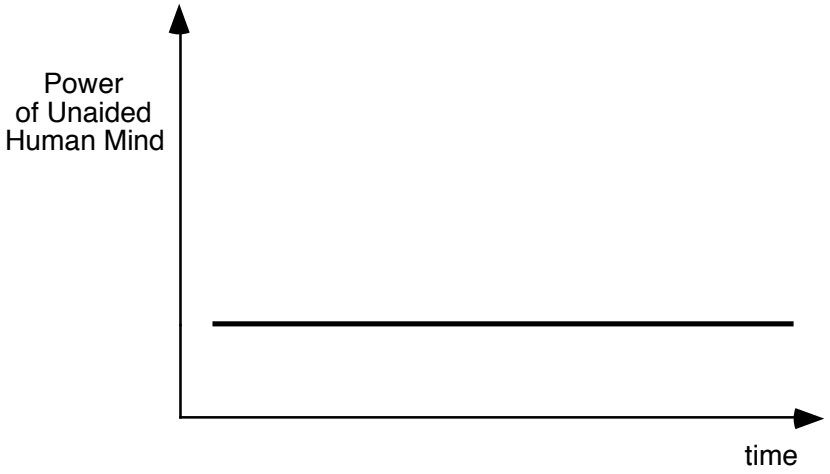
Design, Learning and Collaboration — the "Old" View



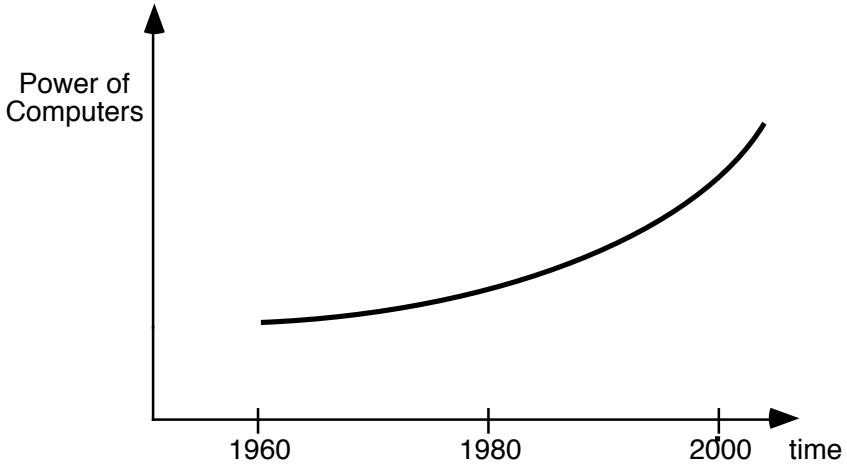
Design, Learning and Collaboration — the "New" View



The Tension between Human and Computational Power



The power of the unaided individual human mind remains constant over time.



Computing power increases at an exponential rate.

Distributed Cognition — Rethinking the Boundaries between Knowledge in the Head and Knowledge in the World

- **Media as Extensions of Humans:** "the story of the human race is one of ever-increasing intellectual capability. Since our early cave-dwelling ancestors, our brain have gotten no bigger, our hands no more nimble, but there has been a steady accretion of new tools for physical and intellectual work."

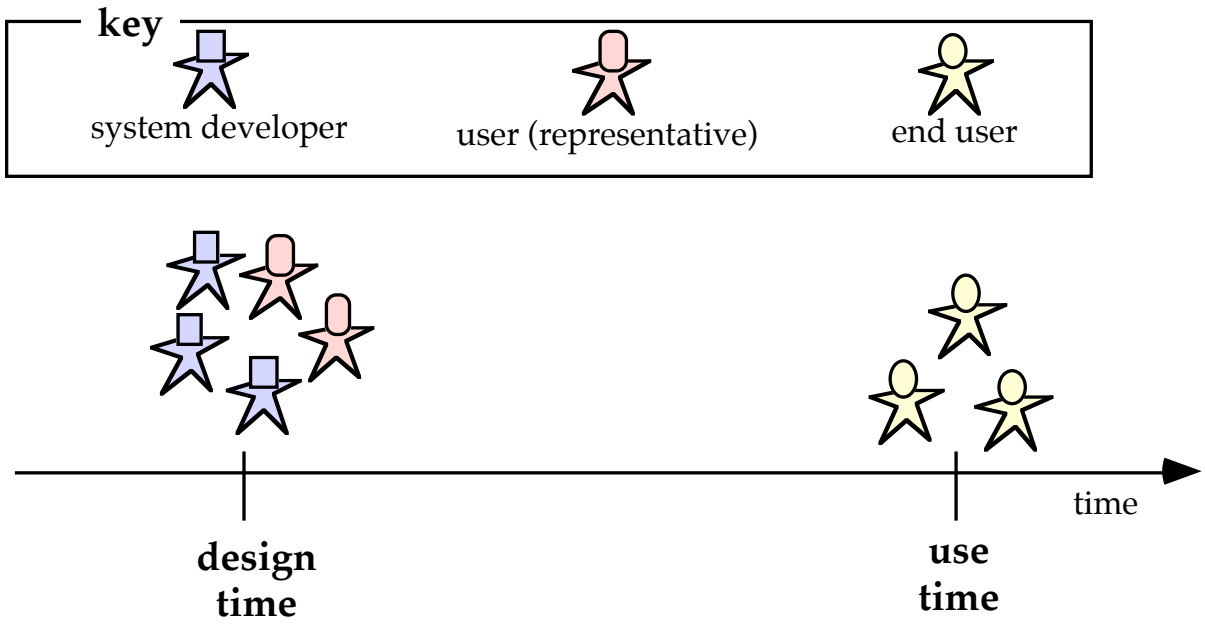
- **Jerome Bruner:**
  - "Human's use of mind is dependent upon her/his ability to develop and use tools or instruments or technologies that make it possible for him to express and amplify her/his powers"
  - "'how the mind works' is itself dependent on the tools at its disposal" (→ "'how the hand works' cannot be fully appreciated unless one also takes into account whether it is equipped with a screwdriver, a pair of scissors, ….."
  - "if a theory of mind is to be interesting educationally, it should contain some specifications for (or at least implications bearing on) how its functioning can be improved or altered in some significant way"

Distributed Cognition — Creating Externalizations

- greatest milestone in the history of externalizations: **literacy** = putting thought and memory “out there” on clay tablets and paper

- claim: **digital media** provide new exciting and still largely unexplored opportunities

Fundamental Difference between Printed and Computational Media



world-as-imagined planning

world-as-experienced situated action

- **print media:** a fixed context is decided at design time
- **computational media**: decision at use time can take advantage of contextual factors only known at use time → end-user programming and modification, customization, specification sheets, usage data, context-aware environments

Design

- **natural science: "how things are"**
  - knowledge about natural objects and phenomena
  - primary interest: analysis
  - examples: physics, chemistry
- **sciences of the artificial: "how things might be**" (and ought to be in order to attain goals and to function)
  - knowledge about artificial objects and phenomena
  - primary interest: synthesis
  - artificial things are as they are only because of a system's being molded, by goals and purposes, to the environment in which it lives
  - examples: engineering, medicine, business, architecture, painting, universities, cognitive artifacts, notations
- **design** = although there is a huge diversity among design disciplines, we can find common concerns and principles that are applicable to the design of any object, whether it is a (scientific, mathematical) notation, a household appliance, a housing development, a software system, ...

Design — Some Relevant Publications

- Simon, H. A. (1996) The Sciences of the Artificial, (Third ed.), The MIT Press, Cambridge, MA.

- Norman, D. A. (1993) Things That Make Us Smart, Addison-Wesley Publishing Company, Reading, MA.

- Schön, D. A. (1983) The Reflective Practitioner: How Professionals Think in Action, Basic Books, New York.

- Winograd, T. (Ed.) (1996) Bringing Design to Software, ACM Press and Addison-Wesley, New York.

- Fischer, G. (1994) "Domain-Oriented Design Environments," Automated Software Engineering, 1(2), pp. 177-203.

Learning

- **lifelong learning** → "learning is inherent in human nature, on ongoing and integral part of our lives, not a special kind of activity separable from the rest of our lives"
- **learning on demand** → the way we learn is trying something, doing it and getting stuck. When we're stuck we are ready for the critical piece of information. The same piece of information that made no impact at a lecture makes a dramatic impact when we're ready for it.
- **learning and teaching:**
  - "A major illusion on which the school system rests is that most learning is the result of teaching" — Ivan Illich (in "Deschooling Society")
  - learning and teaching are not inherently linked → much learning takes place without teaching and **much teaching takes place without learning**
- **learning and working**
  - learning is a new form of labor
  - learning is often a collaborative effort among colleagues and peers
  - more and more knowledge, especially advanced knowledge, is acquired well past the age of formal schooling, and in many situations through educational processes that do not center on the traditional school

Learning — Some Relevant Publications

- Gardner, H. (1991) The Unschooled Mind, Basic Books, Inc, New York.

- Papert, S. (1980) Mindstorms: Children, Computers and Powerful Ideas, Basic Books, New York.

- Rogoff, B., Matsuov, E., & White, C. (1998) "Models of Teaching and Learning: Participation in a Community of Learners." In D. R. Olsen & N. Torrance (Eds.), The Handbook of Education and Human Development — New Models of Learning, Teaching and Schooling, Blackwell, Oxford, pp. 388-414.

- Fischer, G.: "Lifelong Learning - More Than Training", Special Issue on Intelligent Systems/Tools In Training and Life-Long Learning (eds.: Riichiro Mizoguchi and Piet A.M. Kommers), Journal of Interactive Learning Research, Vol. 11, No 3/4, 2000, pp. 265-294. http://www.cs.colorado.edu/~gerhard/papers/lll99.pdf

Collaboration

- **collaboration: a necessity, not a luxury →** the individual, unaided human mind is limited: there is only so much we can remember and there is only so much we can learn

- **collaboration —with whom:**
  - ourselves — e.g., capturing our thoughts of the past
  - all stakeholders — e.g., clients, designers, customers, users
  - colleagues — e.g., supporting long-term, indirect collaboration, software reuse tools — e.g., knowing which tools exist, how they can be used, how they can be tailored to our specific needs
  - critics and agents — e.g., shared knowledge of the task at hand, information volunteering

- **distributed cognition — between:**
  - socially (human beings)
  - technologically (humans and things/computational artifacts)
  - temporally (across time)
  - spatially (across space)

Collaboration —Some Relevant Publications

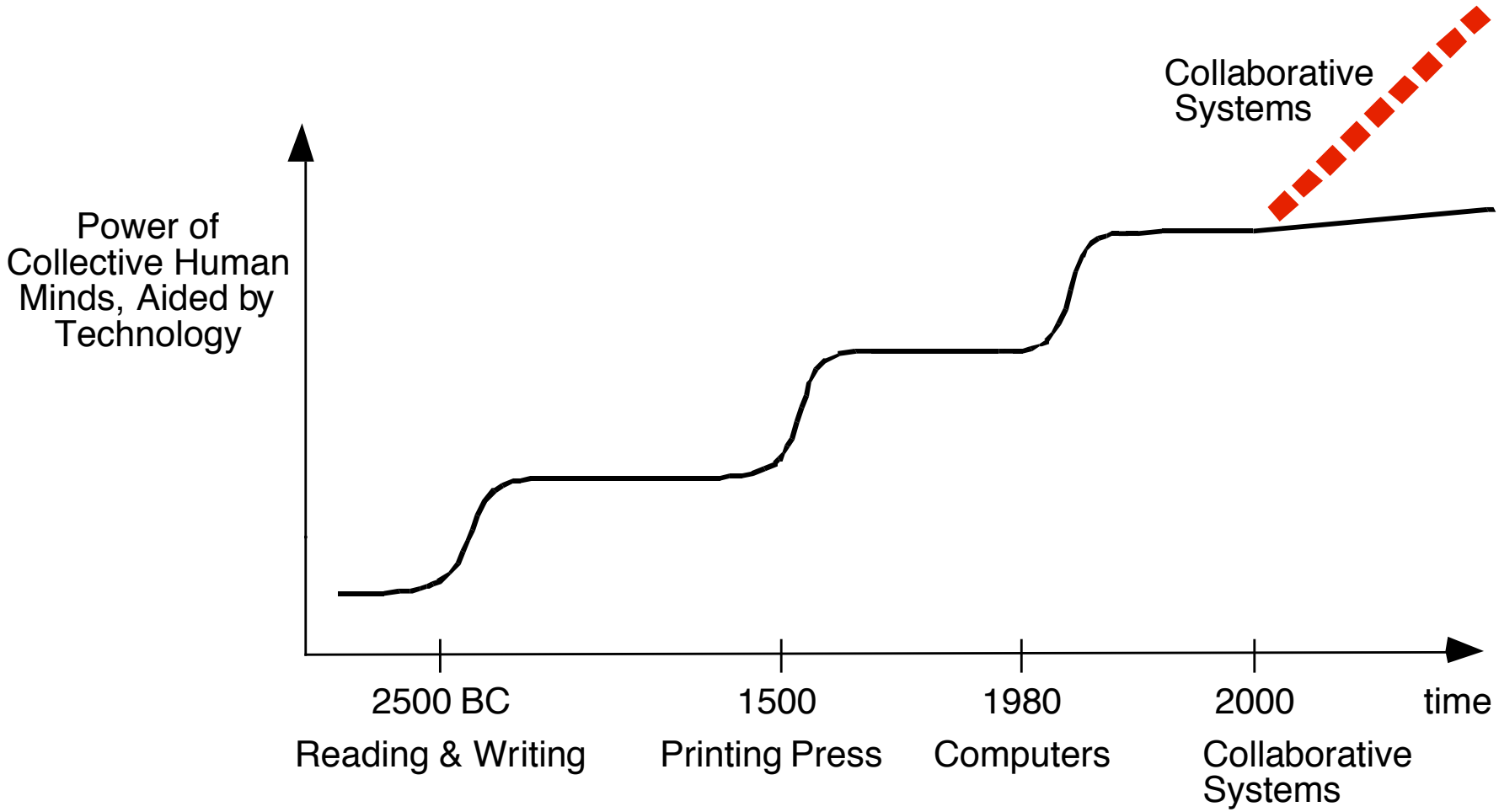
- Resnick, L. B., Levine, J. M., & Teasley, S. D. (Ed.) (1991) Perspectives on Socially Shared Cognition, American Psychological Association, Washington, D.C.

- Koschmann, T. (Ed.) (1996) CSCL: Theory and Practice of an Emerging Paradigm, Lawrence Erlbaum Associates, Hillsdale, NJ.

- Sachs, P. (1995) "Transforming Work: Collaboration, Learning, and Design," Communications of the ACM, 38(9), pp. 36-44.

- Fischer, G. and J. Ostwald (2003): “Knowledge Communication In Design Communities”, in R. Bromme, F. Hesse and H. Spada (ed.), Barriers and Biases in Computer-Mediated Knowledge Communication, 1-32. Kluwer Academic Publishers. [http://www.cs.colorado.edu/~gerhard/papers/fi_ost-final.pdf]

The Aided, Collective Human Mind — Exploiting the Social



Innovative System Development Efforts In Support of Design, Learning and Collaboration

http://www.cs.colorado.edu/~l3d/

Name of System	Objectives / Domain
Domain-Oriented Design Environments (DODEs)	kitchen design, computer network design, voice dialog design, ...
Dynasite / livingOrganizationalMemory	WWW support for collaborative design, Sources, Dynagloss, ...
Agentsheets, Visual AgenTalk, Behavior Exchange	substrates for DODEs, simulation, end-user programming, sharing the work
Envisionment and Discovery Laboratory (EDC)	integrated physical and computational environments
Swiki / Squeak	organizational memories created by collaborative knowledge construction
PiTABoard	**innovative interaction mechanisms in face-to-face-collaboration**
CodeBroker	**software reuse and information delivery**
Clever: Cognitive Levers	**rethinking distributed cognition for people with cognitive disabilities**

The Course

- This course will consist of **lectures, guest lectures, independent research activities by students, demonstration of existing major prototype systems, experiments, and a major project by groups of students.**

- **Independent Research Activities by Students**
  This part of the course will provide students with an opportunity to engage in self-directed learning in the context of independent research explorations (this work is more conceptual and *complements* the work in the course project). Students will present their research about these topics in class some ideas. A list of suggested topics will be provided by the instructor.

- **Major Project (by groups of students)**
  purpose: to gain an in-depth understanding of a theme relevant to the course. Projects need to be carried out through a learning-by-doing approach throughout the semester, preferably as a collaborative activity of team(s).

  Requirements for Projects include:

  - An Initial Description of your Course Project
  - Project Proposal
  - Progress Report
  - Final Report

Expectations about Involvement of Students

- active participation → presence in class
- readings and small assignments
- independent research
- projects
- create a community: (peer-to-peer learning, website)

Grading

Grades will be based on:

- **active and meaningful participation in class** — this will be measured primarily by the quality of the contributions, not by the quantity (obviously zero quantity does not indicate any quality), by interesting, unsolicited contributions of relevance to the class, and by answers to small assignments
- **independent research activities** — including written report and presentation in class
- the quality of the process and outcomes of the **semester project** (a handout about projects will be provided and discussed in an upcoming class meeting)
- a **self-assessment** of the students provided to the instructors at the end of the course.

Weight distribution

assignments and contributions in class	25 percent
independent research	20 percent
semester project	40 percent
self-assessment (which will be honored “as is”)	15 percent

Self-Application: A "New Culture" for this Course

- "symmetry of ignorance" — stakeholders are aware that while they each possess relevant knowledge, none of them has all the relevant knowledge
- teacher, learner = f{person} → **teacher, learner = f{context}**
- the knowledge for (re)solving complex, real-world problems does not exist *a priori*, but is generated through collaboration among stakeholders

Passion for Learning — Beyond Tests