

Massive Open Online Courses (MOOCs) as components of rich landscapes of learning

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Frames of reference for learning in the digital age

Access to affordable education to achieve printed and digital literacy helping all learners to acquire knowledge, coping with change, and seeding mindsets for creativity and intellectual curiosity are considered major indicators and measures of quality of life worldwide. The recent emergence of MOOCs promising new, scalable models that can provide an “education for everyone” has generated a new and broad interest in rethinking learning and education. Frames of reference (identifying underlying assumptions, conceptualizations, and perspectives) [1] are needed to conceptualize the meaning and the implications of MOOCs in the context of rich landscapes for learning. The specific *frame of reference* serving as background for the argumentation in this chapter is to conceptualize learning as a *multi-dimensional activity* with the implication that no single approach will serve all the different needs. A more detailed analysis of *two specific frames of references* is described focused on a differentiation between (1) “learning about” versus “learning to be” and (2) “learning when the answer is known” versus “learning

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when the answer is not known". These perspectives have been influenced by a variety of different philosophies and visions of learning including (1) Dewey's and Bruner's [1] notion that students should be *actively engaged participants* in learning, sharing their knowledge with each other rather than competing to get good grades and (2) Illich's *Learning Webs* (articulated 25 years before the Internet came into existence [2]) representing an early vision for providing all who want to learn with access to available resources at any time in their lives and for empowering all who want to share what they know to find those who want to learn it from them.

The argumentation of this chapter is grounded in research activities, practices, experiences, and beliefs that framed my life as a researcher and teacher in universities. My long-term professional objectives have been focused on:

- the creation of socio-technical environments in which people *want* to learn rather than *have* to learn [3];
- the belief that *teaching and learning are not inherently linked* [4], and therefore there is a lot of learning (specifically in informal learning environments) without teaching and unfortunately there is also a lot of teaching without learning (something which I tried to avoid to the best of my knowledge);
- the assumption that it is more productive, more interesting, and more rewarding to conceptualize the role of teachers and learners not as an attribute of a person, but of a *context* underlying to design *courses as seeds* rather than finished products [5];

- the interest in problems for which no one knows the answer or for which *the* answer does not exist (many students do not come to our classes with a mindset sharing this understanding which I learned from a student's commentary on one of my courses: "*the least one can expect is that the teacher knows the answer*" — even though my objective was to explore problems with the students for which answers do not exist).

The co-evolution between learning, new media, and new learning organizations

Our research in the Center for Lifelong Learning & Design (L3D) at the University of Colorado, Boulder [6] has been grounded in using an analysis of "*how things are*" for the design and development of new socio-technological environments for exploring "*how things could be*".

How things are. The current emphasis on learning is still primarily focused on formal learning taking place in schools and universities but with alternatives such as *informal learning* gaining increasingly more attention [7]. In formal learning environments, learning often follows prescribed paths defined by curricula. Large instructionist lectures are still common (grounded in a transmission model in which learners should learn what teachers know) but numerous approaches to enrich learning experiences with design activities embedded in problem-based design activities are gaining ground [8].

How things could be. A science of learning for the 21st century [9] needs to explore many types of learning other than traditional curriculum-based classroom learning. It must conceptualize learning as an inclusive, social, informal, participatory, and creative lifelong activity. The learning goals and the content of the learning activity should not only be determined by curricula but by interest-based, self-directed learning objectives. Many problems (specifically design problems) are unique and ill-defined and the knowledge to address them is not “out there” requiring contributions and ideas from all involved stakeholders. Learners in such settings must be *active contributors* rather than passive consumers and the learning environments and learning organizations must foster and support mindsets, tools and skills that help learners become empowered and willing to actively contribute [10].

The importance of co-evolution

Providing learners of all ages with the means to become *co-creators* of new ideas, knowledge, and products in personally meaningful activities presents one of the most exciting innovations and transformations of digital media, with profound implications in the years to come. Beyond supporting contributions from individuals, learning organizations need to support cultures and mindsets of sharing, supported by effective technologies and sustained by personal motivation to work for the benefit of groups and communities.

The importance of the *co-evolution* between (1) learning, working and collaboration (2) new media and new technologies, and (3) new learning organizations (see Figure 1) is derived from the fact that human cognitive

activities (such as thinking, learning, teaching, working, and collaborating) have never been independent of media (articulated insightfully by Postman: “*You cannot use smoke signals to do philosophy*” [11]). Historically the most fundamental transformation in these activities has been the invention of reading and writing and the subsequent changes from oral to literal societies [12] (taking place over long periods of time and facilitated by subsequent developments such as the printing press).

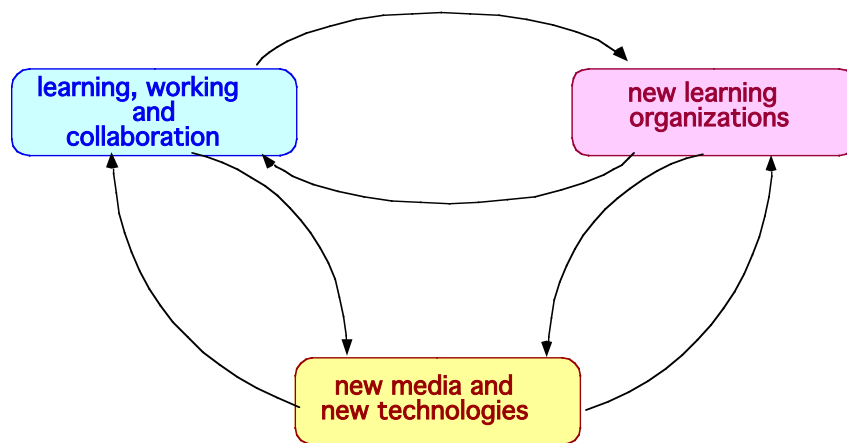


Figure 1: The co-evolution between learning, new media, and new learning organizations

New information and communication technologies have been heralded as the major driving forces behind innovation in learning and education. But many approaches have had only a minor impact based on the reduction to:

- *technology-centered developments* (driven by a sole focus on the yellow component in Figure 1) ignoring that technology alone does not determine social structures but only creates feasibility spaces for new social and cultural practice [13]. Changes in complex learning environments are not

- only dictated by technology; rather, they are the result of an incremental shift in human behavior and social organizations and as such require the co-design of social and technical systems;
- *gift-wrapping* (taken the blue component in Figure 1 as a given) in which new media are used as add-ons to existing practices rather than as catalysts for fundamentally rethinking what education should and can be in the next century [14]. These approaches change the medium, but leave the content unchanged and contribute little to introducing new epistemologies. Existing frameworks, such as instructionism, fixed curricula, memorization, decontextualized learning and so forth, are not changed by technology itself. This is true whether we use computer-based training, intelligent tutoring systems, or multimedia presentations;
 - a sole focus on *existing learning organizations* (not exploring new possibilities of the red component in Figure 1): e-learning environments including MOOCs), peer-support communities [15], and niche communities of special, idiosyncratic interests [16, 17] have provided new opportunities for collaborative learning in virtual communities.

Rich landscapes for learning

Internal and external views of MOOCs

Conceptualizing MOOCs as components of rich landscapes of learning provides the foundation to differentiate an internal and an external view of MOOCs.

An internal view of MOOCs. This internal view analyzes topics that are focused on MOOCs as a specific teaching and learning activity, rather than seeing them as a component of rich landscapes of learning. Figure 2 identifies a number of themes that have been explored in numerous articles discussing topics related directly to MOOCs (e.g. [18, 19]):

1. distinguishing *cMOOCs* (fostering connections and collaborations among learners) and *xMOOCs* (efficiently delivering content to large audiences) [20];
2. differentiating *basic services provided for free* (e.g.: access to courseware) from *premium services that require payment* (e.g.: access to projects, code-review and feedback, personal coaches, and verified certificates);
3. identifying *number of participants* and calculating the *completion rates* for specific courses;
4. analyzing *the educational background of participants* (uncovering the surprising finding that the largest group of participants in xMOOCS have already a Master's degree);
5. findings ways (by automating the process or by supporting peer grading) to *assess the achievements* of large number of participants;
6. taking advantage of capturing large amounts of data for *learning analytics research*;
7. supporting *local meet-up groups* (allowing participants in the same location to meet in person); and

8. establishing *nanodegree programs* in which people (mostly from industry) can acquire specific knowledge and targeted skills without extended time requirements.

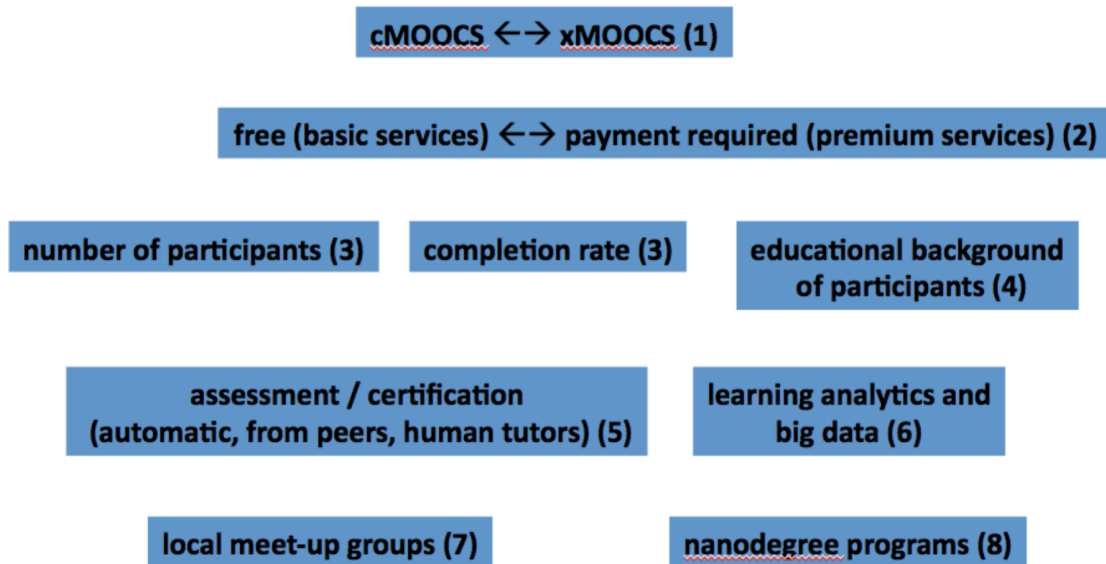


Figure 2: Themes derived from an internal view of MOOCs

An external view of MOOCs. By postulating the need for rich landscapes for learning, the main emphasis on this chapter is focused on an external view of MOOCs. Figure 3 provides an overview and establishes frames of references for future sections of this chapter by identifying the following themes:

1. different forms of learning (lifelong, blended, collaborative) need to be supported and practiced [21];
2. formal learning in schools needs to be complemented by informal learning [7].

3. supply-oriented (“push/ delivery”) models in which learners are presented with knowledge that later may become relevant for them need to be complemented by “pull/ learning on demand” approaches [22].
4. consumer-oriented cultures need to be complemented by participatory cultures [23, 24];
5. “learning about” needs to be complemented by “learning to be” [9];
6. “learning when the answer is known” needs to be complemented by “learning when the answer is not known” (and exploring problems that have no answers) [25].

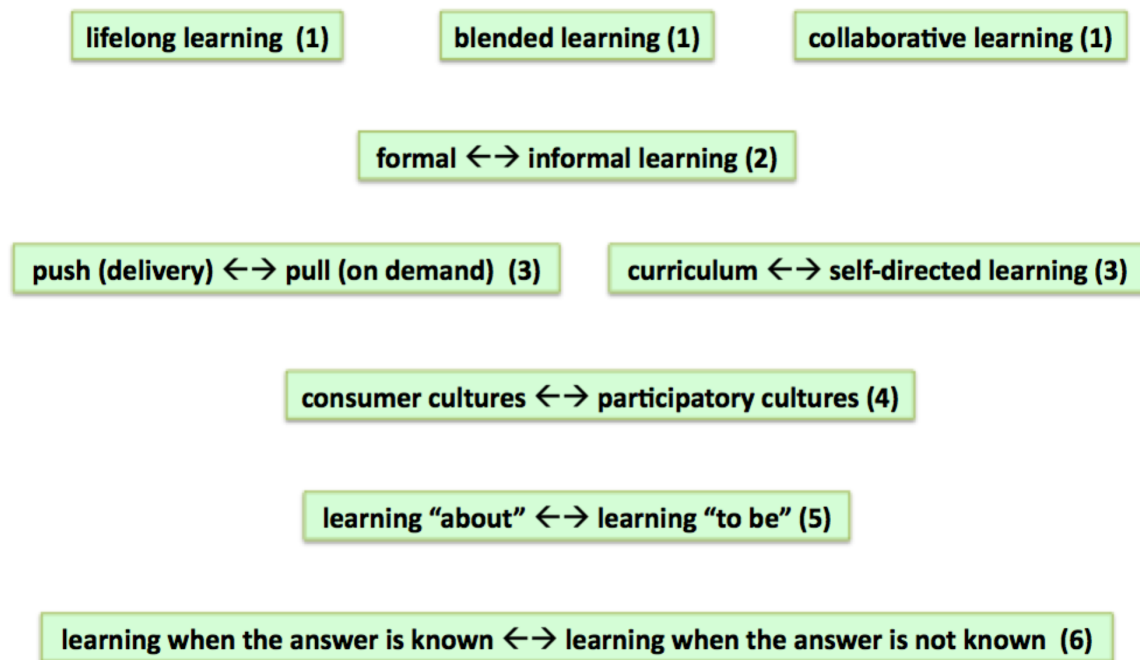


Figure 3: Themes derived from an *external* view of MOOCs

The last two items of the list will be discussed in more detail, because they represent two perspectives differentiating MOOCs from other approaches: MOOCs are focused on learning out and *learning when the answer is known*.

Learning about versus learning to be.

Learning about, as an objective for learning and education, is focused on the accumulation of intellectual capital realized in a curriculum that stresses the communication of culturally central theories, facts, and skills [26]. This curriculum is identifiable and structured as a coherent and fine-grained sequence of educational objectives. Instructionist approaches 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 is focused not as much on teaching about mathematics, physics, or design, as on what it means and takes to be a mathematician, a physicist, a designer, a Wikipedian, a skier, or a surfer. Important dimensions of *learning to be* included: (1) learning by being engaged in personally meaningful problems, (2) teachers engaging in problem-solving activities in front of their students rather than lecturing, and (3) enculturation into communities of practice with legitimate peripheral participation [27]. To promote and support “learning to be”, the Center for Lifelong Learning & Design (L3D) has (1) initiated an “*Undergraduate Research Apprenticeship Program*” supported by NSF REU grants [28] and (2) established and nurtured communities based on “*horizontal and vertical integration*” (bringing together individuals coming from different disciplines and including undergraduates, graduates, post-docs, faculty members, and people in industry). Learning to be involves enculturation, which can be articulated by as follows ([29], p 220):

“engaging with communities of practice and of concepts. Teaching and education, from this perspective, are not simply matters of putting in touch with information. Rather, they are matters of putting students in touch with particular communities. The university’s great advantage is that it can put learners in touch with communities that they don’t know about.”

Based on this brief characterization, my basic assumption is: MOOCs can make interesting contributions to “learning about”, whereas residential research-based universities should focus more on “learning to be”.

Learning when the answer is known versus learning when the answer is not known

In many introductory courses (particularly in disciplines belonging to the natural sciences [30] such as mathematics and physics), the answer to the problems discussed in courses exists and is known by the teacher, and the core challenge is *“for learners to learn what the teacher knows”*. But in many other situations (e.g., exploring wicked, ill-defined design problems), the answer is not known by any stakeholder; instead, all participants engage in collaborative knowledge construction and evaluation processes. In many of these problem-solving situations, a correct, final “answer” does not exist.

Theorists like Bruner argue that the most important gift of cultural psychology to education is the reformulation of the impoverished conception that

“teaching is fitted into a mold in which a single, presumably omniscient teacher explicitly tells or shows presumably unknowing learners something they presumably know nothing about” ([1], p 20).

In settings where *“the answer is not known and the right answer may not exist”*, information and knowledge is not a commodity to be consumed but is collaboratively designed and constructed, emphasizing innovation, continuous learning, and collaboration as important processes in which learners and workers as stakeholders create new knowledge as they carry out their problem framing and problem solving activities. The role of the omniscient teacher does not exist in such settings:

“In important transformations of our personal lives and organizational practices, we must learn new forms of activity which are not there yet. They are literally learned as they are being created. There is no competent teacher. Standard learning theories have little to offer if one wants to understand these processes” ([31], p 138).

Contributions to a research agenda for learning in the digital age

Research is needed to explore a range of open issues about learning in the digital age, particularly exploring challenges facing higher education:

- What does it mean to be educated in today’s world?
- How to stimulate interest, motivation and collaboration?
- How far will technological developments take future MOOCs?
- How “free” will MOOCs be in the future?

What does it mean to be educated in today's world?

Learning and education are experiencing a period of profound transformation. Phenomena such as globalization, increasing trends to outsource high-level cognitive tasks, and the need to participate effectively in addressing complex world problems are changing how we think, learn, work, and collaborate. New knowledge and skills for students in entering work environments require collaborations with experts from multiple fields, the pursuit of several career paths, and interacting and working with people of diverse backgrounds. These changes create new educational demands: learners need to be educated for a diverse, technical, problem-oriented world that does not yet exist.

The dramatic changes in people's lifetime in the last decades make *lifelong learning* a necessity. *Learning on demand* needs to be supported to address the impossible demand of coverage and the guaranteed occurrence of obsolescence. The student body is changing: many "students" are not traditional students in residence on a university campus anymore, but professionals who have already earned a degree, educators, business people, researchers, and citizens who want to be lifelong learners. The competition between universities is increasing with alternatives such as the Open University, the University of Phoenix, and broadly available open educational resources. The qualification system is moving to a more competency-based world in which there will be less interest in how someone acquired competencies. The *ubiquitous availability of tools* (e.g.: both

Apple and Google claim that they offer more than 800,000 apps for their respective platform) will make memorization and rote learning skills less relevant and put more emphasis on distributed cognition, using on demand, and learning on demand. Education need to support the shift from “knowing the answers” to “knowing how to find the answers”.

Rich landscapes for learning supported by innovative information and communication technologies are needed, in which learners of all ages can pursue topics of interest and take responsibility for their own education by empowering them to thrive and participate as co-designers in collaborative environments with ever-changing disciplinary boundaries.

How to stimulate interest, motivation and collaboration?

Learning resources are necessary — but they by themselves are not sufficient. Learners of all ages in today’s world (maybe not in a village in Africa or Nepal, but in North America and Europe) have in almost all cases more or less infinite learning resources at their disposal. The fundamental limitation for these learners is therefore not access to information but *the interest, passion and willingness to engage in serious learning activities in the context of personally meaning problems.*

Fundamental open questions facing MOOCs from this perspective are:

- What does and will motivate students and citizens to become seriously engaged to participate in MOOCs?
- What will motivate teachers to offer a MOOC?

The answer to both questions appears to be that people (whether they are learners or teachers) get involved in activities when they are personally meaningful to them and when they are rewarded for their activity (e.g., creating a needed or desired artifact, framing and solving an interesting problem, learning about something exciting, or earning a documented qualification and reputation).

As far as collaboration is concerned, estimates in June 2015 indicate that around 4,000 MOOCs exist and new MOOCs are created at a rapid pace. This raises the following fundamental research challenges: (1) how do learners find the best-matched learning resources to their personal interests and (2) how can learners differentiate between excellent and lousy MOOCs? They can be handled by *warehouses* and *global directories* of MOOCs (sites such as [32]), which are important initial developments needed to assist newcomers to find courses of greatest interest that suit their level of education and needs.

How far will technological developments take future MOOCs?

MOOCs have been influenced and supported by innovative technological developments including (1) delivering content (interwoven with quizzes) to large audiences, (2) providing feedback (e.g.: with automatic grading), and (3) affording communication among participants (e.g. with discussion forums, peer grading, and rating systems for identifying the importance of questions). Many of these developments are still in an early stage of development. MOOC providers are actively engaged to address current shortcomings: for example, to

develop better natural language processing for eliminating the restriction of automatic grading approaches to multiple choice questions.

An important question to ask is: will technologies ever get good enough in digital education to mimic the ease and richness of interaction we see in face-to-face settings? Hypotheses derived from empirical studies in remote collaboration concluded that “Distance Matters” [33]:

“even with the best design of high-bandwidth, display of appropriate proxemics, access to shared objects, etc., there will always be things about the remote situation that make it qualitatively different than collocation. These include aspects of common ground and context, the effects of differing time zones, cultural differences, and various interactions among these and technology.”

To identify the factors that (independently of technological progress) will differentiate MOOCs from smaller, face-to-face courses represents an important item on the MOOCs research agenda. Some of the open issues that need to further investigated are:

- Do MOOCs work well only for students who are self-motivated and already fairly well educated?
- Do MOOCs have the potential to enable participants to be autonomous learners capable of managing their own learning pathways?
- Are MOOCs able to establish a community feeling among the students taking the course?

- Do MOOCs create an increased appreciation of and dependency on courses (1) in which instructors are authority figures, (2) for which objective information exists (math, physics, algorithms) and the answers are known by the instructors, or do they diminish the appreciation for courses (e.g., in design and philosophy) in which the answers are not known and/or do not exist?
- Do MOOCs hinder changes and experimentation with courses based on their high production costs?

The most significant issue, however, is the following:

- Do the low completion and certification rates provide a good metric for the inadequacy of MOOCs?

In relation to this question I believe that the data that less than 5% to 10% of participants signing up for a MOOC completing them is one of the most *misleading* metrics. These findings are terrible if MOOCs are compared to courses taught in classrooms at universities. But the data is much less worrisome if the following perspectives are taken into account: (1) conceptualizing MOOCs as textbooks of the 21st century (because nobody expects that textbooks need to be read from the first to the last page); (2) considering the numerator (representing the number of students who finish) as the relevant figure rather than the fraction of numerator over the denominator (representing the number of students who signed up). To analyze a specific example: 5% of a MOOC with 100,000 participants are 5,000 students — a larger number of students that many faculty members teaching conventional courses at universities have taught throughout their lifetime); (3) many students signing up for a MOOC do not so for obtaining

a degree but learning something of interest to them (i.e.: finishing with a certification is of no interest to them).

How “free” will MOOCs be in the future?

The promise “Education for Everyone and for all Interests for Free” generated the excitement about MOOCs. To make the creation of MOOCs sustainable in the long term requires business models that do not exist yet. Current developments indicate that in the future only the “*basic services*” (e.g.; the lectures) will remain free whereas the “*premium services*” (e.g.: providing mentoring, feedback, and certification) will have to be paid for.

The search for sustainable business models has been a major challenge for MOOCs providers. The envisioned premium services generating income may include [19]:

- *certification* — students pay for a badge or certificate;
- *secure assessments* — students pay to have their examinations proctored (as practiced with Coursera’s Signature Track [34]);
- *applicant screening and employee recruitment* — companies pay for access to student performance records (e.g., 3,000 students have signed up for Udacity’s employer-connection program, allowing their CVs to be shared with 350 companies. Employers pay Udacity a fee for any hires made through this service [35]);
- *human tutoring or assignment marking* (for individual students who pay for them) and tutors supporting forum to operate more successfully;

- *hotline services* to support learners experiencing problem with content and/or technical issues;
- *selling MOOC platforms* to enterprises to use in their courses;
- *sponsorships* (third party sponsors of courses); and
- *tuition fees* (illustrated by the experiment of the Computer Science Department of Georgia Tech that has decided to offer a Master's Degree delivered with MOOCs for a fraction of the cost what a "normal" degree costs [36]).

Conclusions

From my personal point of view, the most important contribution of MOOCs is that they generated a broad and (so far) lasting discourse about learning, teaching, and education in which not only narrow, specialized academic circles participate, but the media, universities administrators, and politicians got involved. This chapter has discussed arguments that MOOCs can and should be conceptualized and developed as important components of rich landscapes of learning needed for the 21st century.

Rather than ignoring MOOCs and only grounding and evolving them in economic and political perspectives, the *research community in the learning sciences* should get seriously involved with MOOCs and influence their evolution. Even the loudest critics of MOOCs do not expect them to fade away. More likely, they will morph into many different shapes (e.g.: the "basic services" provided by

MOOC 1.0 will be complemented by the “premium services” developed and envisioned in MOOC 2.0).

Researchers from the learning sciences should not only collect data about existing practices, but they should develop visions, explore important open issues, and investigate the pro and cons of fundamental design choices faced by learning in the digital age including: what are the trade-offs between (1) an *inexpensive* educational infrastructure in which students can afford at least a minimal education or (2) an *expanded* infrastructure in which MOOCs are complemented not only by residential universities, but by all the other components contributing to rich landscapes of learning.

References

1. Bruner, J. (1996) *The Culture of Education*, Harvard University Press, Cambridge, MA
2. Illich, I. (1971) *Deschooling Society*, Harper and Row, New York
3. Fischer, G. (2014) Supporting Self-Directed Learning with Cultures of Participation in Collaborative Learning Environments. In *Problem-based Learning for the 21st Century - New Practices and Learning Environments* (E. Christiansen, et al., eds.), pp. 15-50, Aalborg University Press
4. Wenger, E. (1998) *Communities of Practice — Learning, Meaning, and Identity*, Cambridge University Press, Cambridge, UK
5. dePaula, R., G. Fischer, and J. Ostwald (2001) Courses as Seeds: Expectations and Realities, in *Proceedings of The European Conference on Computer-Supported Collaborative Learning* (P. Dillenbourg, A. Eurelings, and K. Hakkarainen, eds), pp. 494-501, Maastricht McLuhan Institute, Maastricht, Netherlands
6. L3D (2015) *Center for LifeLong Learning and Design*, University of Colorado, Boulder, Available from: <http://l3d.cs.colorado.edu/>
7. National-Research-Council (2009) *Learning Science in Informal Environments — People, Places, and Pursuits*, National Academy Press, Washington, DC
8. Hmelo-Silver, C.E. (2004), Problem-Based Learning: What and How Do Students Learn? *Journal of Educational Psychology Review*, **16**(3), 235-266

9. Brown, J.S (2005) *New Learning Environments for the 21st Century*, Available from: <http://www.johnseelybrown.com/newlearning.pdf>
10. Fischer, G. (2002) *Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors*, in *FirstMonday (Peer-Reviewed Journal on the Internet)*, Available from: http://firstmonday.org/issues/issue7_12/fischer/
11. Postman, N. (1985), *Amusing Ourselves to Death—Public Discourse in the Age of Show Business*, Penguin Books, New York
12. Ong, W.J. (1982), *Orality and Literacy*, Routledge, London
13. Benkler, Y. (2006), *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, Yale University Press, New Haven
14. Fischer, G., et al. (2005), Beyond Binary Choices: Integrating Individual and Social Creativity. *International Journal of Human-Computer Studies (IJHCS)*, Special Issue on Computer Support for Creativity (E.A. Edmonds & L. Candy, Eds.) **63**(4-5), 482-512
15. Gorman, A. and G. Fischer (2009) Toward an Analytic Framework for Understanding and Fostering Peer-Support Communities in Using and Evolving Software Products. In *Proceedings of the International Conference Communities and Technologies (C&T'2009)*, pp. 1-9, Penn State University
16. Collins, A., et al. (2009) Long-Tail Learning: A Unique Opportunity for CSCL?, In *Proceedings (Vol 2) of CSCL 2009: 8th International Conference on Computer Supported Collaborative Learning*, p. 22-24, University of the Aegean, Rhodes, Greece
17. Brown, J.S. and R.P. Adler (2008) *Minds on Fire: Open Education, the Long Tail, and Learning 2.0.*; Available from: <http://www.educause.edu/ir/library/pdf/ERM0811.pdf>.
18. Hollands, F.M. and D. Tirthali (2014) *MOOCs: Expectations and Reality*; Available from: http://www.academicpartnerships.com/sites/default/files/MOOCs_Expectations_and_Reality.pdf.
19. Daniel, J. (2012): *Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility.*; Available from: <http://www-jime.open.ac.uk/jime/article/viewArticle/2012-18/html>.
20. Bates, T (2014) *Comparing xMOOCs and cMOOCs: philosophy and practice.*; Available from: <http://www.tonybates.ca/2014/10/13/comparing-xmoocs-and-cmoocs-philosophy-and-practice/>.
21. Bransford, J.D., A.L. Brown, and R.R. Cocking, eds (2001) *How People Learn — Brain, Mind, Experience, and School.*, National Academy Press, Washington, D.C.
22. Collins, A. and R. Halverson (2009), *Rethinking Education in the Age of Technology: The Digital Revolution and the School*, Teachers College Press, New York, NY
23. Jenkins, H. (2009), *Confronting the Challenges of Participatory Cultures: Media Education for the 21st Century*, MIT Press, Cambridge, MA
24. Fischer, G. (2011), Understanding, Fostering, and Supporting Cultures of Participation, *Journal ACM Interactions* **XVIII.3** (May + June 2011), 42-53

25. Engeström, Y. and A. Sannino (2010) Studies of expansive learning: Foundations, findings and future challenges. *Journal Educational Research Review* 5(1), 1-24
26. Hirsch, E.D. (1988), *Cultural Literacy: What Every American Needs to Know.*, Vintage, New York, NY
27. Lave, J. and E. Wenger (1991), *Situated Learning: Legitimate Peripheral Participation*, Cambridge University Press, New York, NY
28. L3D-URAP (2015) *Undergraduate Research Apprenticeship Program*; Available from: <http://l3d.cs.colorado.edu/urap/>.
29. Brown, J.S. and P. Duguid (2000) *The Social Life of Information* Harvard Business School Press, Boston, MA
30. Simon, H.A. (1996) *The Sciences of the Artificial*, The MIT Press, Boston, MA
31. Engeström, Y. (2001) Expansive Learning at Work: Toward an Activity Theoretical Reconceptualization, *Journal of Education and Work*, 14(1), 133-156
32. MOOCs-Directories (2015), Available from: <http://www.mooc-list.com/>; <http://www.moocs.co>
33. Olson, G.M. and J.S. Olson (2001) Distance Matters, In *Human-Computer Interaction in the New Millennium* (Carroll, J.M., ed.), pp. 397-417, ACM Press, New York
34. Coursera (2014) *Signature Track Guidebook.*; Available from: <https://www.coursera.org/signature/guidebook>
35. Ripley, A. (2012) *College Is Dead. Long Live College!* Available from: <http://nation.time.com/2012/10/18/college-is-dead-long-live-college/print/>.
36. Georgia-Tech (2014) *Online Master of Science in Computer Science.*; Available from: <http://www.omscs.gatech.edu/-np-855>