

## Beyond Hype and Underestimation: Identifying Research Challenges for the Future of MOOCs

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### Abstract

Massive Open Online Courses (MOOCs) have generated enthusiasm, excitement, and hype worldwide and recently increasing skepticism. They are being broadly discussed in the major news media (and to a smaller extent in academic circles). Rapidly increasing numbers of MOOC providers, MOOC courses, and articles, discussion groups, and blogs discussing MOOCs are indicators of the involvement of many stakeholders. Most of these analyses and developments are based on *economic perspectives* (such as scalability, productivity, being “free”) and *technology perspectives* (including platforms supporting large number of students in online environments, enrichment components such as forums, peer-to-peer learning support, and automatic grading). Few contributions analyze MOOCs from a *learning science perspective* and put them into a larger context with other approaches to learning and education. This commentary explores challenges derived from the perspective to conceptualize MOOCs as being one component in a rich landscape of learning.

### Keywords

Massive Open Online Courses (MOOCs); learning science perspective; limiting factors; want-to-learn; core competencies of residential, research universities; rich landscapes of learning

### Introduction

Massive Open Online Courses (MOOCs) are Higher Education courses with massive enrollments that promise *education for everyone and for all interests for free*. This special issue is a timely publication and the authors have collected insights and data for specific aspects related to MOOCs. The articles represent peer-reviewed research activities (very few of those exist) complementing the much larger numbers of press releases, opinion articles, and reports. By taking the research documented in this special issue into account, this commentary represents an attempt to create frames of reference for analyzing and reflecting about past, current, and future MOOCs developments.

### The Hype and the Underestimation

The *hype* surrounding MOOCs manifest itself in statements such as the one by the New York Times that declared 2012 the “*Year of the MOOC*” [Pappano, 2012] and Thomas Friedman’s claim “*Nothing has more potential to lift more people out of poverty*” [Friedman, 2013]. From an economic perspective, many people believe that MOOCs will address the fundamental challenge to contain the costs how to teach more students using fewer resources.

The *underestimation* of MOOCs can be found in statements such as “*In fact, 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.*” [Vardi, 2012]). This condemnation may be a dangerous mistake in response to the undeniable attraction of MOOCs: (1) attracting

more than a 100,000 students in many classes, (2) being a subject of discussion in all media, and (3) university administrators competing with their institutions not be left out of the frenzy surrounding MOOCs. The underestimation voices were greatly supported by Sebastian Thrun's (being considered one of the Godfathers of the xMOOC approach) statements that Udacity MOOCs were "a lousy product" and "not a good fit" for disadvantaged students [Chafkin, 2014]. Another reason for the underestimation may be based on the current early development cycle of MOOCs and the assumption that their primitive capabilities will remain static and will evolve insufficiently over time.

As MOOCs are a very recent phenomenon, both the hype and the underestimation of MOOCs are more based on assumption and beliefs than theoretical groundings and qualitative and quantitative data. As with many data collection efforts, the data collected are the data that are the easiest to collect, not necessarily the most relevant ones. The MOOC providers try to show their success with number of participants (derived from the number of user accounts), number of courses offered (total number as well as differentiated between subject areas), and list of universities that collaborate with them and use their respective platforms for their courses.

One of the most central points of discussion thus far has been the low completion rates for courses (used by the opponents of MOOCs as evidence for their limitations). The University of Pennsylvania Graduate School of Education [Stein, 2013] provided data that on average, only about 50 percent of those who registered for a course ever viewed a lecture, and only about 4 percent completed the courses. Taking into account how easy it is (requiring often just a few mouse clicks and no costs associated with it), the total number of people signing up for a course as well as the low completion rates should be put in perspective. If 100,000 people signing up for a course, the vast majority may do so without an intention to finish the course; but a 4 percent completion rate still means that 4,000 people finished the course. This number may be larger than a faculty member teaching courses in a residential university has taught in many years of service. While the background, age, and countries of origin vary among participants, an interesting initial finding was that a very high percentage of participants in MOOCs were people who had already a degree [Klawe & Schofield, 2014].

### Identifying Limiting Factors

The main part of my commentary consists of an attempt to articulate some specific ideas and objectives about a vision for a research agenda influenced (a) by my own experiences as a professor over several decades, (b) by my understanding and analysis of MOOCs courses, interviews and discussions with MOOCs authors, objectives of MOOCs providers, and (c) by the contributions in this special issue. In doing so, I hope to make a small contribution towards establishing frames of reference that will productively move our understanding and practice of learning in the 21<sup>st</sup> century forward.

Innovations do not work on the first try. Iterations driven by formative evaluations are key to learn from shortcomings and mistakes. With the hype and the underestimation of MOOCs as the two end points of the spectrum of an analysis, it is too early either (1) to believe on the one hand that they will be the answer to "Education for Everyone and for all Interests for Free" nor (2) that the time has come to give up on MOOCs. To make progress in creating the best environments fitting the learning needs of the 21<sup>st</sup> century, we need to ask the truly relevant questions and to identify the truly limiting resources.

Research is needed to explore a range of open issues about the following open questions:

- 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 in which instructors are authority figures, 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?

**From "Have to Learn" to "Want to Learn".** Being interested in lifelong learning and design, I have considered it one of the major objectives of my professional life to create socio-technical environments in which people "*want to learn*" rather than "*have to learn*". In order to identify design guidelines, I have analyzed

success models of active, voluntary engagement in skiing, playing with LEGO, and in *cultures of participation* (such as: Wikipedia, open source, and MAKER movement) [Fischer, 2011]. People engage in self-directed learning if they have or are able to develop an (often idiosyncratic) interest and passion for a domain of knowledge or an activity.

Whether or not a particular learning environment (e.g., a specific MOOC course or MOOC platform) will succeed will be highly dependent whether students can learn what they want and when they want, freed from curricula of desirable and less desirable content into majors and degree programs.

**Lack on Interest and Motivation.** 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 in the future 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? People get involved in activities when they are personally meaningful to them and when they are rewarded for their activity (e.g., by creating an interesting artifact, framing and solving an interesting problem, learning about something they find exciting, or earning a documented qualification and reputation). Through the right kind of technologies (platforms for developing MOOCs, forums to support peer-to-peer learning, interactivity to provide feedback) we can reduce the effort to be engaged and learn something.

**Information and Participation Overload.** To engage learners as active contributors in cultures of participation can lead to collaborative knowledge construction, coping with problems where the answer is not known, and reconceptualizing courses as seeds [dePaula et al., 2001] (the seed being provided by the instructor and the evolutionary growth of ideas, insights, and concepts contributed by the students). Participatory pedagogy (as discussed in the article by *Andersen and Ponti* in this issue) give learners the opportunity to act as agents who can create course content in Web 2.0 environments. I have practiced this approach for several years in the courses taught at the University of Colorado with small numbers of students. A possible assumption is that this approach would work even better with MOOCs in which many more voices can make a contribution. *Knox* (in his contribution to this special issue) provides empirical evidence that this may not be the case by identifying the challenges and the problems with user-created content:

- material created by students was often considered excessive and/or irrelevant;
- most students (independent of the respective quality) associate a higher value to teacher-provided material than to contributions provided by peers;
- the volume of ideas and comments can disorientate learners, especially those who have difficulties to decide which information is of relevance to their concerns.

These problems could be addressed by establishing and supporting *curator roles* to organize these potentially large information spaces or to create powerful *output filters* to find the “needles in the haystack”.

**Warehouses of MOOCs Courses.** New MOOCs courses are created at a rapid pace. It will be true for MOOCs (as it is true for *all* artifacts created by humans in all domains) that there will excellent, good, and poor instances. This will create a need for *warehouses* of MOOCs (the directory at <http://www.mooc-list.com/> is an important first step in this direction). These developments will assist newcomers to find the courses of greatest interest, suiting their level of education and needs, and they will complement and enrich the currently existing descriptions of courses offered by MOOCs providers.

**How Far will Technological Developments Take Future MOOCs?** MOOCs have been influenced and supported by innovative technological developments (1) delivering content (interwoven with quizzes) to large audiences, and (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).

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: could the technology ever get good enough in distance 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” [Olson & Olson, 2001]: “*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.

**How “Free” will MOOCs be in the Future?** As stated before: this contribution is not focused on the economic aspects of MOOCs. But the promise “Education for Everyone and for all Interests for Free” generated the excitement about MOOCs and the 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.

Is education “free” in any society? Free educational opportunities are provided by numerous organizations including (1) public libraries; (2) lecture material (provided by: OpenCourseware, Khan Academy, and iTunesU); and (3) open educational resources (provided by: Wikipedia, TED Talks, YouTube movies, Physics Education Technology Project (PhET), etc.). In Germany, universities are “free” in the sense that students do not pay fees for them because universities are supported by tax money from all citizens rather than by the fees of the students attending them. One may argue that environments created by *cultures of participation* can and should be free as they are created by contributors who are rewarded by social capital and by gaining a reputation in a gift culture rather than being paid.

How are and will be professors teaching MOOCs financially rewarded for their efforts? In case their universities consider this as part of their jobs — what motivates university administrators (beyond the fear not to be left behind) to give their faculty members time for MOOC students, of which almost all are not students at their universities? After the initial engagement (hoping to reach fame and have substantial impact) will faculty members sustain their engagement in MOOCs in case teaching a MOOC distracts them from their normal on-campus duties?

**MOOCs are not free anymore.** At this moment no convincing business models exist. The search for sustainable business models has been a major challenge for MOOCs providers. The envisioned premium services generating income may include [Daniel, 2012]:

- *certification* — students pay for a badge or certificate;
- *secure assessments* — students pay to have their examinations proctored (as practiced with Coursera’s Signature Track [Coursera, 2014]);
- *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 [Ripley, 2012]);
- *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* (3rd 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 Degree delivered with MOOCs for a fraction of the cost what a “normal” degree costs [Georgia-Tech, 2014]).

## Core Competencies of Residential, Research-Based Universities

Research in the learning sciences in the last two decades has explored and emphasized the importance of “self-directed learning”, “problem-based learning”, “active learning”, “peer-to-peer learning”, and “flipped classrooms” — but despite all these insights, much of academic teaching still consists of professors presenting

instructionist monologues to large classes. I firmly believe that a course with more than 100 or 200 students at a residential university will not differ in substantial ways from a MOOCs course.

Education is more than delivering content and learning is more than knowing specific information and facts — particularly when it is looked upon from a lifelong learning perspective. It is about thinking critically and asking questions, about finding ways to see the world from different points of view rather than one's own.

A focus of my personal interests is to add value to learning and education by promoting core competencies of residential, research-based universities by identifying learning activities and objectives that are not “moocable”. A variety of themes (analyzing MOOCs from the following perspectives: the learning sciences, collaborative work, embodied cognition, and learning analytics) are discussed in more detail in [Eisenberg & Fischer, 2014]). In this commentary I will briefly discuss the interesting division between “learning *about*” and “learning *to be*” [Brown, 2005] (p5). To learn *about* focuses on the accumulation of intellectual capital, organized into curricula that stresses the communication of culturally central theories, facts, and skills. A curriculum of this sort is most naturally structured as a sequence of educational objectives. The methodology for “learning *about*” is frequently linked to the introductory lecture-hall style of information delivery, augmented with readings, problems, and tests as often practiced in large, introductory classes.

In contrast, learning *to be* is to focus less on teaching mathematics, physics, or history, and more on what it means and takes to be a mathematician, a physicist, or a historian (or a Wikipedian, skier, or surfer). “Learning *to be*” approaches engage students in personally meaningful problems, encourage teachers to model problem-solving activities in front of or alongside their students rather than lecturing, and enculturate students into communities. In the context of this discussion, the current limitations of MOOCs (and the need for learning science research) could be characterized as enhancing the ability of new modes of education to foster “learning *to be*” through conversation, varied communities, physical activity, participatory settings, and anthropological methods. If MOOCs have their strength in addressing the “learning *about*” agenda then the core competencies of residential, research-based universities should emphasize the “learning *to be*” objectives.

“Learning *about*” and “learning *to be*” represent *antinomies* [Bruner, 1996]: pairs of complementary truths, each worthwhile to be pursued in different contexts, but also presenting learners and educators with tensions and contradictions. Antinomies of this kind have woven their way, historically, into enduring design trade-offs in the learning sciences: for instance, whether computers should be designed as independent stand-alone *intelligent tutors* or as *intelligent assistants*, or *expressive tools of communication*, or as some mixture of these and other artifacts. Over time, we are likely to come to view MOOCs and their offspring through the lenses of similar antinomies.

The attempt to identify the core competencies of residential research-based universities does not imply that we should simply see them as the gold standard for learning and education. There may be a number of objectives that are better served by MOOCs such as learning communities defined by shared interests rather than shared location and access by individuals to lectures that they would not have otherwise. Just as Amazon offers more books than any physical bookstore (exploiting the “Long Tail” distribution [Anderson, 2006]), the number of available courses in future MOOC warehouses can be substantially larger than the number of courses any university can provide.

A fundamental challenge is to envision and create symbiotic relationships between MOOCs and courses at universities. MOOCs can serve the same purpose that textbooks have served for decades: for examples as resources for “flipped classrooms”. In case they are constructed as seeds giving instructors the power to modify and enrich them (as indicated in the paper by Andersen and Ponti), the teaching community can profit from the educational production of others.

Local modifications may sometimes be a necessity rather than an option in localizing courses. The global reach of MOOCs will provide an opportunity to confront and acquaint learners with different ways of thinking. But the particular challenges of courses reaching beyond the borders of individual countries need to be carefully explored including: how to establish common ground and shared understanding by incorporating on locally relevant issues, needs and understanding.

For example: in a MOOC about energy sustainability, the lecturer may use the gas consumption of cars as an example. The familiar representations in the USA are miles for distance and gallons for gas whereas in many other countries kilometers and liters are used. Beyond the different measurements, the consumptions is conceptualized differently: in the USA, the amount of gasoline is fixed and the energy efficiency are measure

how far a car can go with one gallon whereas in Europe the distance is fixed (one hundred kilometers) and the efficiency is measured how much gas is needed to cover this distance.

## Rich Landscapes of Learning

As the demands for learning undergo a period of profound transformation, there is a need for exploring innovative multi-dimensional aspects of learning. Figure 1 provides an overview of the multi-dimensional aspects of learning.

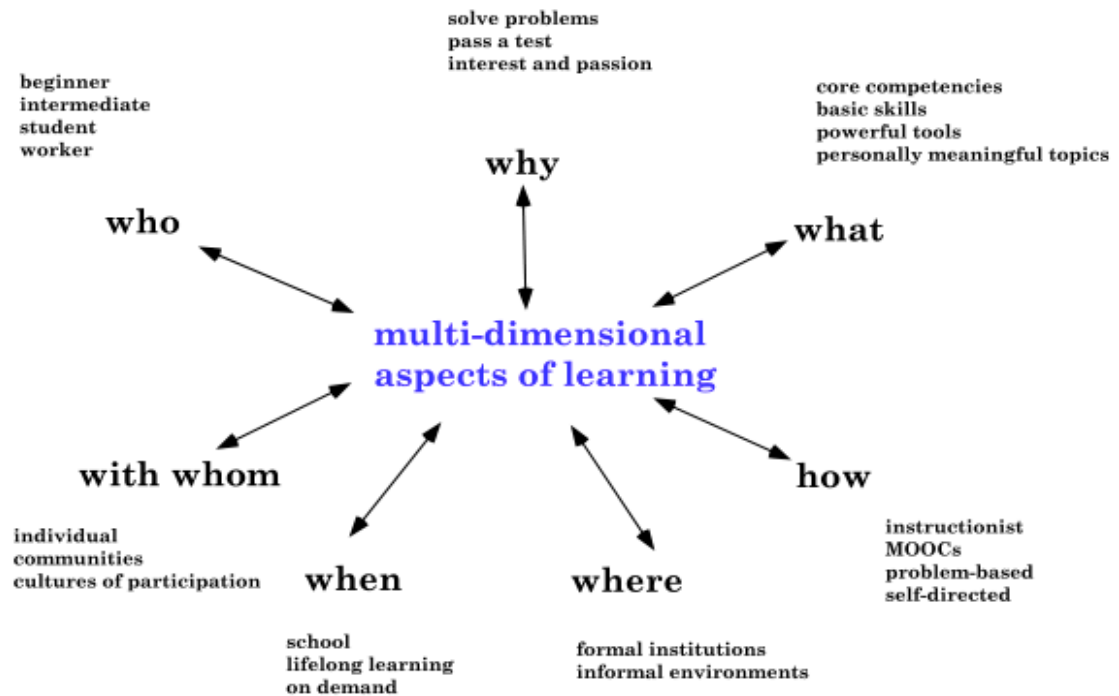


Figure 1: A Rich Landscape of Learning

What is needed now, more than ever, are theories and practices that bridge the numerous design trade-offs between formal and informal learning, didactic and experiential learning, peer-based and master-based mentoring, local and distributed learning, the cognitive and the social dimensions of learning. We also need to explore new kinds of computational platforms that can enhance the potential synergy between these contrasting pairs. This is where the research efforts of the learning sciences should be focused on.

## Conclusions

Personally, I see the biggest contribution that MOOCs have achieved 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 administrations, politicians, and many others. If the future developments will move in interesting directions (neither being solely dominated by hype nor underestimation) MOOCs (and online education more generally) can represent an important component of the learning environments needed for the 21<sup>st</sup> century. Are we after *uniform, standard, globalized* high-quality education (a chance to take the very best introductory courses for every student in the world)? Or are we after *highly personalized, idiosyncratic* pathways of learning acquired by self-directed activities?

Rather than ignoring MOOCs and only grounding and evolving them in in economic and political perspective, 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 different design choices. For example: what are the trade-offs between (1) an *inexpensive* educational infrastructure (in which students can easily afford at least a minimal education, and in which the resources associated with residential universities are scaled back) or (2) an *expanded* infrastructure (in which online education is complemented not only by residential universities, but by all the other component contributing to a rich landscape of learning as indicated in Figure 1)?

This commentary (inspired by the articles in this special issue) attempted to make a contribution to the following challenges: (1) to create frames of reference to understand the role of MOOCs specifically from a learning science perspective (in addition to economic and technological perspectives); (2) to move beyond the exaggerated hype and total underestimation surrounding MOOCs; (3) to identify the unique contributions of MOOCs to a rich landscape of learning; (4) to analyze MOOCs as a forcing function in identifying the core competencies of residential, research-based universities.

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## References

- Anderson, C. (2006) *The Long Tail: Why the Future of Business Is Selling Less of More*, Hyperion, New York, NY.
- Brown, J. S. (2005) *New Learning Environments for the 21st Century*, available at <http://www.johnseelybrown.com/newlearning.pdf>.
- Bruner, J. (1996) *The Culture of Education*, Harvard University Press, Cambridge, MA.
- Chafkin, M. (2014) *Udacity's Sebastian Thrun, Godfather of Free Online Education, Changes Course*, available at <http://www.fastcompany.com/3021473/udacity-sebastian-thrun-uphill-climb>.
- Coursera (2014) *Signature Track Guidebook*, available at <https://www.coursera.org/signature/guidebook>.
- Daniel, J. (2012) *Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility*, available at <http://www-jime.open.ac.uk/jime/article/viewArticle/2012-18/html>.
- dePaula, R., Fischer, G., & Ostwald, J. (2001) "Courses as Seeds: Expectations and Realities." In P. Dillenbourg, A. Eurelings, & K. Hakkarainen (Eds.), *Proceedings of the European Conference on Computer-Supported Collaborative Learning*, Maastricht McLuhan Institute, Maastricht, Netherlands, pp. 494-501.
- Eisenberg, M., & Fischer, G. (2014) "MOOCs: A Perspective from the Learning Sciences." In *Proceedings of ICLS 2014*, Boulder, p. (forthcoming). Available at: <http://l3d.cs.colorado.edu/~gerhard/papers/2014/ICLS-MOOCs.pdf>.
- Fischer, G. (2011) "Understanding, Fostering, and Supporting Cultures of Participation," *ACM Interactions* XVIII.3 (May + June 2011), pp. 42-53.
- Friedman, T. L. (2013) *Nothing Has More Potential to Lift More People out of Poverty*, available at <http://www.nytimes.com/2013/01/27/opinion/sunday/friedman-revolution-hits-the-universities.html>.
- Georgia-Tech (2014) *Online Master of Science in Computer Science*, available at <http://www.omscs.gatech.edu/#np-855>.
- Klawe, M., & Schofield, E. (2014) *The Evolving MOOC*, available at <http://www.educause.edu/ero/article/evolving-mooc>.

- Olson, G. M., & Olson, J. S. (2001) "Distance Matters." In J. M. Carroll (Ed.), *Human-Computer Interaction in the New Millennium*, ACM Press, New York, pp. 397-417.
- Pappano, L. (2012) *The Year of the MOOC*, available at <http://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html>.
- Ripley, A. (2012) *College Is Dead. Long Live College!*, available at <http://nation.time.com/2012/10/18/college-is-dead-long-live-college/print/>.
- Stein, K. (2013) *Penn Gse Study Shows MOOCs Have Relatively Few Active Users, with Only a Few Persisting to Course End (University of Pennsylvania Graduate School of Education, Press Release)* available at <https://www.gse.upenn.edu/pressroom/press-releases/2013/12/penn-gse-study-shows-moocs-have-relatively-few-active-users-only-few-persisti>.
- Vardi, M. Y. (2012) "Will MOOCs Destroy Academia?," *Communications of the ACM (CACM)*, 55(11), p. 5.

## Short Bio

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