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### Interactive learning online: Challenges and opportunities

Mihaela C. Sabin

*University of New Hampshire, Manchester, mihaela.sabin@unh.edu*

Amber Settle

*DePaul University*

Becky Rutherford

*Southern Polytechnic State University*

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# Interactive Learning Online: Challenges and Opportunities

Mihaela Sabin (moderator)  
University of New Hampshire  
Manchester, NH 03101  
mihaela.sabin@unh.edu

Amber Settle  
DePaul University  
Chicago, IL 60604

asettle@cdm.depaul.edu

Becky Rutherford  
Southern Polytechnic State University  
Marietta, GA 30060  
brutherf@spsu.edu

## SUMMARY

Higher education is a labor-intensive sector. Smaller classes, more faculty-student direct interactions, prompt and individualized feedback, and more hands-on and collaborative learning with peers raise the quality of student education. Valuable person-to-person interactions, on the other hand, are costly and, to complicate matters, indicative of the Baumol's cost disease [1]. Labor-intensive sectors that are dominated by personal services, such as education and health care, do not have rising productivity through technological innovations. These "stagnant sectors", says William Baumol, keep up with salaries in sectors where more is produced with less, like in manufacturing, by raising costs.

Since the early 1990s online education and online learning systems have held the promise of increasing instructional productivity and reducing costs without sacrificing educational quality. There is no evidence to date that such promise has materialized. The impetus of the newest developments with free online courses offered by Ivy League research universities to hundreds of thousands of students might drastically transform how we teach more and better with less. The innovation that prompted this panel is called Interactive Learning Online (ILO), and has the distinctive feature of highly interactive, machine-guided instruction that can be scaled to accommodate a large number of students who benefit from targeted and personalized learning [2].

A generic software platform that would permit faculty at diverse institutions to develop ILO content with customized feedback loops and machine-guided interactivity does not exist. Bacow et al. [2] observe that it would be "foolishly inefficient to rely on a 'hundred flowers' approach". They recommend that we collectively investigate how to: (1) design, develop, and maintain

## Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]:  
Computer science education

## General Terms

Design, Experimentation, Human Factors, Management

## Keywords

Online learning, online learning platforms, personalized learning

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ILO content; (2) share student performance data tracked with ILO tools to research how students learn and how technology can facilitate teaching; and (3) participate in the creation of sustainable and customizable ILO platforms. This is a compelling IT problem, for which IT educators have the technical and educational expertise.

The panelists have experimented with online learning in different ways. Their perspectives underline the challenges with improving student learning outcomes in an online environment and the difficulties with current technologies and selection of more advanced online learning tools. The panelists' institutions, at the time the panel proposal was submitted, did not have access to platforms such as Coursera (coursera.org) and EdX (edxonline.org), to see first-hand how ILO content is developed and learning analytics managed. Like the vast majority of educators who have taught online courses, the panelists have used course management systems (CMS) where ILO activities are limited to discussion boards and student breakout groups. They have enhanced their online teaching with video content and synchronous online activities through live web conferencing. Social media and cloud computing services have also been used to make the online learning environment affordable and learner-centered.

## 1. Amber Settle

When online learning was introduced in the College of Computing and Digital Media (CDM) at DePaul in a broad way in 2001, the goal was to provide a large variety of online courses while minimizing the impact on the faculty and the regular sections of courses [4]. Hundreds of courses are recorded each quarter using an in-house hardware and software system called Course Online (COL), and many of these classes have an associated online section where the students substitute class attendance with asynchronous viewing of the recordings. More recently a number of online-only classes tailored to that population have been developed. As a fulltime instructor at CDM since 1996, I have taught 17 COL-enabled online courses and developed two distinct online-only courses, which I taught a total of 13 times. The development and modification of the online-only courses has shown me that interactive learning is crucial for online student success and satisfaction.

When developing the online-only Java course, I followed these principles to facilitate student success and satisfaction:

- Create very short recordings and focus on solving relevant problems. The longest recording was 30 minutes, and many were less than 10.
- Include exercises with immediate feedback. I used the CodeLab system, but many other equivalent systems are available.

- Require students to make regular postings in a discussion forum to share tips and frustration with one another.
- Create new (very short) recordings each week in response to student questions and difficulties to ensure a more robust faculty-student dialog.

As an unexpected consequence of the course structure, the recordings became a “pull” resource, with some students only accessing the recordings to reinforce concepts not easily understood from the textbook or lecture notes. Interestingly, some students watched all the recordings, sometimes repeatedly, demonstrating that approaches to learning vary, and the course structure needs to be flexible enough to accommodate individualized learning. Course evaluations from the online Java class were significantly higher than evaluations from similar COL online courses.

## 2. Becky Rutherford

As we think about the future of IT online education, we need to examine ways in which we can use our own knowledge of the IT field to allow for innovative and exciting new ways of developing online content. Most of our traditional institutions do not have the monetary resources to compete with well-endowed institutions. MIT’s OpenCourseWare (OCW) spends \$10,000 to \$15,000 and requires 100 staff-hours to publish a single course: collect and compile course materials from faculty, ensure proper licensing for sharing, and format materials for the OCW site. Courses with video content cost twice as much. Carnegie Mellon University’s Open Learning Initiative is often cited for the sticker price of \$1 million per state-of-the-art, rigorous course with interactive videos that embed intelligent tutoring tools [4]. This up-front, one-time cost gets amortized over time when the course reaches an equilibrium state and is reused with no or minimal changes.

Using traditional course management systems has been the standard for most of our creation of online courses and modules. To improve student learning and direct engagement with the teaching material, IT education departments should take an active role in evaluating, selecting, and integrating tools and services that emphasize more teaching and learning interactions. Some newer technologies include the Echo 360 lecture capture system (echo360.com), which allows for full video and audio capture (including student responses to questions) of the teacher’s live delivery of instructional modules. The video/audio recordings can then be stored into the CMS for easy access and use. This product can cost upwards of \$20,000-25,000 per classroom installation if all new equipment is purchased and the storage is hosted off-campus. If used with existing computing infrastructure (equipment, projectors, and microphones) costs are significantly lowered. Echo 360 can be enhanced with Wimba Live classrooms that allow remote students to use live, real-time web conferencing and interact with peers and instructor.

After teaching online now for several years and seeing the improvements of CMSs and other online tools over the last few years, I am confident that the availability of more sophisticated online learning products will allow us to create online content in a much more efficient and cost-effective manner.

## 3. Mihaela Sabin

An alternative to prohibitively expensive plug-and-play, monolithic CMS’s is to disaggregate the development and delivery of ILO content through the use of open source and/or free software. Online Q&A, student online portfolios, or project wikis are examples of ILO content that I have developed and curated with social media tools and cloud services such as Piazza (piazza.com), Google Sites (sites.google.com), MediaWiki (mediawiki.org), and Google Code (code.google.com) [5].

I have used Piazza for the online Q&A content of my courses in the past two years. My role is to structure and prompt weekly conversations with 2-3 questions. Besides the Q&A standard activities, student participation in Piazza includes commenting, editing of peers’ contributions, and “thumb-up” endorsements of useful tips and explanations. Piazza software has effective analytics that I easily tie into assessing student engagement in online activities. Students use Google Sites to create online portfolios in which they assemble learning artifacts for formative and summative assessment: solutions to assigned homework and projects, self-evaluations, status reports, and self-reflections. The wiki revision history controls in Google Sites help students with an iterative submission approach and informs me about how progress was made. For team projects, students use a MediaWiki installation on a server in the lab to document and keep track of their work openly and collaboratively. For the source code, we use Google Code project hosting service and its version control and issue tracking tools.

Replacing an instructor-controlled CMS with a suite of tools and services that are under student control is analogous to trading “one-size-fits-all” with a personalized learning environment that is a step closer to an ILO platform. My use of ILO-like tools did not increase productivity as measured by student-to-teacher ratio. Instead, student self-directed experiences became more productive when students personalize learning from a dynamic, social network of resources. This shift from top-down, CMS-centralized teaching to student-pull online learning has freed up time in my classes for interactions that do not yet have (and might never have) an online counterpart.

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