Promoting Active Learning & Leveraging Dashboards for Curriculum Assessment in an OpenEdX Introductory CS Course for Middle School

Shuchi Grover1, Roy Pea1 & Stephen Cooper2
1Graduate School of Education, 2Computer Science Department, Stanford University, CA

MOTIVATION
Lack of teachers to teach computer science (CS) and pedagogically sound introductory CS curricula remain a significant challenge facing secondary schools attempting to teach CS. This paper describes our work-in-progress to design and pilot an online 7-week middle school course using Stanford’s OpenEdX platform. Given the crucial shortage of K-12 CS teachers and curricula, well-designed online courses deployed on MOOC platforms could serve a crucial need in K-12 as well, especially in blended learning settings.

METHODS
‘Foundations for Advancing Computational Thinking’ (FACT)- an Exploring CS’-lite’ course for middle school was designed and deployed on Stanford’s OpenEdX platform. FACT aims to help learners appreciate the pervasive nature of computing while engaging in algorithmic problem-solving and concepts such as serial execution, loops, and conditions (using Scratch). We piloted FACT as a SPOC[3] in blended mode over 7 weeks to study its use in a “Computers’ elective class that met four times a week for 55-minute periods at a public middle school.

Leveraging OpenEdX Modular Architecture for Active ‘Deeper’ Learning
OpenEdX’s modular course design architecture affords various types of “elements” that can be added to a page. This aids use of –
- Contextual “anchored” discussion prompts below instructional videos.
- HTML code to “iframe” links to activities for students to engage in.
- For example, in addition to the video on a page, we iframe-d:
  - http://scratch.mit.edu so students could try out–and build on–programming ideas discussed in the video;
  - Qualtrics surveys to obtain student feedback (for design-based research [H]) and responses to open-ended “thought questions”.
- “Low stakes – high frequency” multiple-choice quizzes (of various types); provide immediate feedback; push understanding; expose gaps.

Leveraging OpenEdX Dashboards for Curricular Assessment & Refinement
While a primary goal of automated assessments is to assess student learning, data and metrics generated by MOOC platforms are useful as aids to curriculum evaluation as well.
- Actively used instructor dashboards on quiz data provided by OpenEdX to ascertain targets of difficulty and prompt course revision.
- Figuring out the incorrect option that students most often chose for a wrong answer also helped better understand student misconceptions.
- Figure 1 shows a screenshot of the dashboard that clearly points to gaps in student understanding of the topic. This prompted (mid-course) course correction to aid better understanding.

DISCUSSION
Instruments measuring computational learning showed significant learning gains for all students after the FACT SPOC. Students on OpenEdX FACT performed as well or better on post-tests than students in an earlier face-to-face iteration of the course. Post-course student feedback has been encouraging. Future plans include making the course broadly available as a MOOC, especially for use in diverse classroom settings by teachers.

REFERENCES