

Transforming STEM Education through Digital Teaching Networks

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Mastery of the peculiar and powerful practices of science is increasingly important for the average citizen. This has led to an urgent call for widespread adoption of empirically validated teaching practices, including replacement of lectures by discovery-based and active learning (Singer et al., 2012; PCAST, 2012).

Digital learning environments and new pedagogies are being developed to meet this need, using technology to teach in ways that are interactive and adaptive to the learner, and that enable new modes of assessment that reach large scale. The first waves of innovation centered on openly available simulations (e.g., PhET), videos (e.g., Khan Academy), and Massively Open Online Courses - MOOCs (e.g., via Coursera and EdX), emphasizing global scale. Interactivity, adaptivity, and sophistication of assessments are steadily improving, increasingly driven by learning sciences research.

However, while these digital education resources democratize access, they are typically designed “top-down” from the vision of a single instructor, small team, company, or institution, and are not intended to be modified. The result is a barrier to adoption, especially in diverse settings. This problem grows with the sophistication of the learning experience. Hence, *adoption at scale* is hindered by the difficulty of *adaptation at scale*.

New possibilities are opened by the emergence of authoring platforms for adaptive learning (e.g., Smart Sparrow). Learning experiences developed in such platforms can be customized for diverse student needs, individualized to instructors’ visions, rapidly modified, distributed, and reused. This can be done collaboratively by *digital teaching networks* of instructors working with disciplinary experts and learning scientists. The result is a fundamentally new modality—*adaptive scaling*—that avoids centralized design, obsolescence, and a “one size fits all” approach.

We will present examples of established and emerging STEM education networks relevant to geosciences, and the innovations they enable.

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