

INTERACTIVE ASSESSMENTS IN OPEN SOURCE TEXTBOOKS

organized by

Jim Fowler, Mitch Keller, Matthew Leingang, and Oscar Levin

Workshop Summary

Goals and Focus

The original goal of the workshop was to be devoted to improving the quality of open educational resources and increasing their adoption. Specifically, the workshop sought to transform open textbooks to better support instructors in the assessment of students by exploring the following:

- Draft specification for interactive elements, including assessments, that seamlessly integrate into the textbook allowing dynamic updating of content throughout the text to create a customized learning trajectory for individual learners.
- Identify best practices for creating and selecting pedagogical features within open textbooks, such as reading questions, graphical manipulatives, animations, videos, and scaffolded multi-step problems.
- Investigate methods of storing and analyzing learner events in a decentralized and scalable manner so that instructors can freely and easily assess their students and authors can universally assess their textbooks.

Daily Activity Summary

Each of the first four days of the workshop began with presentations by participants on various topics related to the goals of the workshop. We heard from:

- Brad Miller about Runestone
- Dante Tawfeeq on interactions with K-12
- Emma Smith Zbarsky about accessibility
- Jim Fowler about Doenet
- Mohamed Iqbal Jamalooden on Georgias state-funded OER
- Rob Beezer about PreTeXt
- Spencer Bagley with a math education perspective
- Steven Clontz about standards based grading

The first afternoon consisted of a moderated problem session. The group brainstormed ideas for topics to address specifically over the next few days. Subsequent afternoons consisted of small breakout groups that took on some of the topics suggested the first day.

Friday began with demonstrations and longer reports on progress made by the working groups. Later on Friday, there was a discussion of where to go next and how to sustain our efforts. Friday afternoon gave participants an opportunity to wrap up some projects and plan for future collaborations.

Topics and progress

Coordination of PreTeXt and Runestone Interactive: A significant challenge for instructor adoption of OER is the lack of gradebook integration. Ideally, an instructor would receive information (perhaps within their university's Learning Management System) about the extent to which their students are engaging with the textbook. Runestone, originally created for interactive computer science textbooks, already provides a gradebook and connection to an outside LMS.

As a specific example, a Runestone Interactive textbook may include various questions embedded into the narrative of the text, e.g., multiple choice questions can be embedded in the middle of the text. The markup is semantic: for instance, a multiple choice item is stored in Runestone as a `<ul data-component="multiplechoice" ...>` since from some perspective, a multiple choice question is a sort of list. PreTeXt can be instrumented to output suitable HTML that can be digested by Runestone; preliminary work along these lines was undertaken by the workshop participants.

Markup for assessments in PreTeXt: Markup for questions of various types (like multiple choice questions, and “multiple multiple choice” or rather “select all that apply”) was established in PreTeXt, along with desired HTML output suitable to be digested by Runestone Interactive as described above. Some challenges include how to mark-up suitable remedial feedback for distractors.

User Interface for assessments (reading questions, etc): A group met to brainstorm ways a assessments can be presented on the page, as seen by the students, and then seen by instructors after the students have submitted their work. For example, when and how should a student's response to a reading question be submitted? In this case, the group agreed that the text a student answers should be automatically saved, but that the student should have the responsibility and the right to submit their work to their instructor when they are satisfied. An instructor interface that presents responses one-by-one and saves grade and feedback was proposed. Students should see their responses and instructor feedback in the book at the location of the reading question when logged in. A User interface for multiple choice questions was also discussed, although this seems more straightforward.

Assessments of various types (not necessarily automatically gradable): The workshop participants ideated around “unusual” assessment types that might still serve a pedagogical purpose. An example of such is a collaborative problem where multiple students visit a common page, and each student is able to control one part of the webpage. Students must then work together in order to solve the given problem. Another example of an unusual interactive is a heatmap where students in a large class make their best guess about the centroid of an object. Such a “wisdom of the crowds” demo may help students recognize how multivariable calculus coheres with their own intuition. Another group brainstormed a variety of assessments (both formative and summative) that could be added to OER textbooks and not automatically graded. It was determined that there is a wide range of such assessments and this is a hard problem to continue working on.

Instructor editions: Groups initially discussed what features an instructor edition should have, such as instructional tips, links to worksheets, links to slides, and question banks. These resources are frequently provided by commercial publishers and are important for adoption, particularly in circumstances where instructors have

limited experience teaching collegiate mathematics. Providing multiple formats (including Word when possible) is important for community college settings. Generally, in HTML, these items would appear in the right-hand margin. The group described some desired markup for instructor resources in a PreTeXt book. Based on these discussions, David Farmer was able to create a demonstration of what an instructor edition page of a PreTeXt HTML book would look like.

Building community: Discussion centered around how to support authors and instructors (and instructors who want to become authors). In particular, how to build a community around a textbook to help busy instructors, and perhaps novice instructors, teach well out of the book. Part of this is addressed by the instructor edition discussion, but it is also important to connect instructors with each other and with the author to help each other grow as instructors.

Future plans

Participants at the workshop strengthened the tie between PreTeXt and Runestone. A reasonable next goal will be to get a PreTeXt-authored book working inside Runestone with assessments built in WeBWorK and then to use it in a course. The Runestone lead developer connected with workshop participants from Minnesota to establish a collaboration.

Another project underway is Doenet, a decentralized platform for recording grades and learning events on a variety of webpages, without requiring instructors to manage servers. AIM facilitated extremely valuable interactions between the MathJax team and the Doenet developers.

There is now a Google group <https://groups.google.com/forum/!forum/oer-authors-group> for OER authors to discuss and share best practices for high-level authoring decisions and community-building. A Slack channel <https://aimoerworkshop.slack.com> was also created for workshop participants to continue communicating about projects after the workshop.

Additionally, the workshop concluded with participants signing up for various groups to continue the work done already. Here are the groups and participants. Anyone interested in working in a group they are not already signed up for should contact the leader of the group, indicated with *.

The group sign-ups were:

Getting student scores to instructors: Kevin Charles, Lynda Danielson, Jim Fowler, Oscar Levin, Brad Miller, Dave Rosoff*, Drew Youngren

Collecting usage data: Spencer Bagley*, Kevin Charles, Jim Fowler, Mitch Keller, Brad Miller, Emma Zbarsky,

Instructor customization: David Farmer, Mitch Keller, Oscar Levin, Melissa Lynn, Sara Malec, Brad Miller, Emma Zbarsky*

Community of Authors/instructors: Spencer Bagley, Kevin Charles, Lynda Danielson, David Farmer, Alex Jordan, Tom Judson*, Mitch Keller, Oscar Levin, Sara Malec, Brad Miller, Kent Morrison, Nishan Mudalige, Dave Rosoff, Bruce Yoshikawa, Drew Youngren, Emmz Zbarsky

Randomization of exercises: Kevin Charles, Steven Clontz, Mohamed Jamalood-
een, Matthew Leingang, Nishan Mudalige, Brian Walton*, Drew Youngren

GeoGebra Assessments in PreTeXt: Steven Clontz, Robin Cruz, Lynda Danielson, Alex Jordan, Melissa Lynn*, Dave Rosoff, Bruce Yoshikawa, Kathy Yoshikawa, Drew Youngren

Instructor Editions: Spencer Bagley, Steven Clontz, Robyn Cruz, Lynda Danielson, David Farmer, Mohamed Jamaloodeen, Tom Judson, Mitch Keller*, Oscar Levin, Melissa Lynn, Sara Malec, Brad Miller, Nishan Mudalige, Dave Rosoff, Cathy Yoshiwara, Emma Zbarsky.

Integration of Technologies: David Famer, Alex Jordan, Brad Miller*, Dave Rosoff

Moving forward with new markup and new interactives: Melissa Lynn, Brian Walton, Drew Youngren*

Non-computational (interactive) assessments: Spencer Bagley, Kevin Charles, Steven Clontz, Keiko Dow, Mohamed Jamaloodeen, Mitch Keller, Matthew Leingang*, Oscar Levin, Melissa Lynn, Sara Malec, Nishan Mudalige, Brian Walton, Kathy Yoshiwara, Drew Young, Emma Zbarsky.

How students read books in our disciplines: Sara Malec*, Spencer Bagley, Tom Judson, Brian Walton, Emma Zbarsky, Matthew Leingang, Oscar Levin, Brad Miller, Drew Youngren, Dave Rosoff.

Curation of exercises for assessments: Steven Clontz*, Spencer Bagley, Emma Zbarsky, Sara Malec, Brad Miller, Oscar Levin, Kevin Charles.