

# Open Learning Initiative, Echo Authoring, and Community Development for Computer Science Education

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## ABSTRACT

The Open Learning Initiative (OLI) is an online learning environment for the delivery of effective online courses in a variety of domains. OLI offers an authoring tool, Echo, that allows anyone to create OLI courses. These tools each provide learning analytics for monitoring student performance, course health, and effective design. OLI and Echo are part of a larger educational technology ecosystem at Carnegie Mellon University, the OpenSimon Toolkit. These tools are available and open-sourced for computer science (CS) educators to take advantage of, and to part of a larger community of computer science educators and educational researchers.

## Author Keywords

OLI, online learning, cs education, learning science, e-learning, open learning, opensimon, learning science, learning analytics

## TOOLS FOR THE DELIVERY AND DEVELOPMENT OF CS EDUCATION

OLI is an exemplar of CMU's learning engineering approach at scale. Over the past decade, OLI courses have seen enrollments from over 5 million independent learners. These same courses have been used to support academic classes in hundreds of institutions of higher education and high schools, with more than 500,000 enrollments in these types of credit-bearing contexts. Experts in learning science, human computer interaction, instructional design, assessment, and software engineering work with disciplinary experts to create open online learning environments based on the integration of technology and the science of learning with teaching. These course materials are designed to enact instruction online in support of an individual learner and to support more effective classroom instruction. OLI has developed over 40 online courses and associated partnerships with many colleges.

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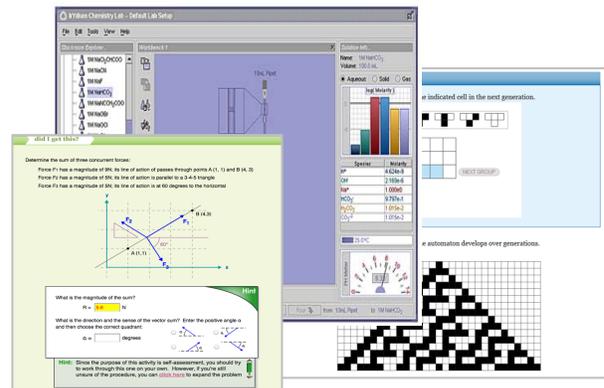


Figure 1: OLI activities allow students to learn by doing.

Numerous studies have shown the effectiveness of the OLI approach [1, 3, 4], and the use of OLI in CS topics [2]. Recent innovations from OLI have supported a broader population in authoring and customizing effective learning materials, with a particular focus on leveraging data to support iterative improvement.

In addition to delivering high-quality courses developed with OLI Learning Engineers, OLI offers an easy and free to use authoring tool, Echo. Teachers and educational researchers can author their own course content with Echo. Echo can be used to customize existing open educational resources (OER) materials and evaluate those materials from a data-science perspective. Educational researchers can use these tools to study different instructional strategies and interventions. Echo offers built-in features like the ability to tag content to outcomes, analytics to show learning model fit, and analytics to help guide iterative improvement decisions.

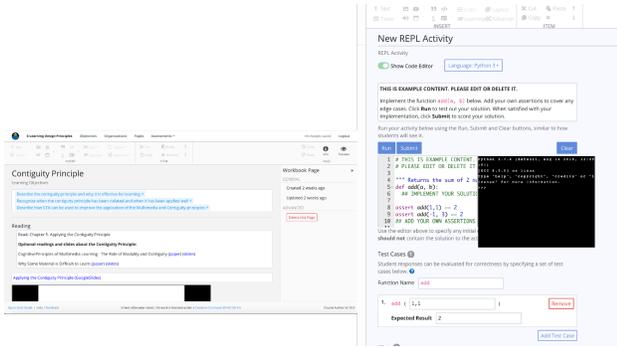


Figure 2: Echo Authoring provides a WYSIWYG editing experience.

### OPENSIMON TOOLKIT FOR ANALYSIS AND ITERATIVE IMPROVEMENT

OLI's built-in analytics help an instructor to determine where students struggle most, and help to monitor student performance, through its Learning Dashboard visualization.

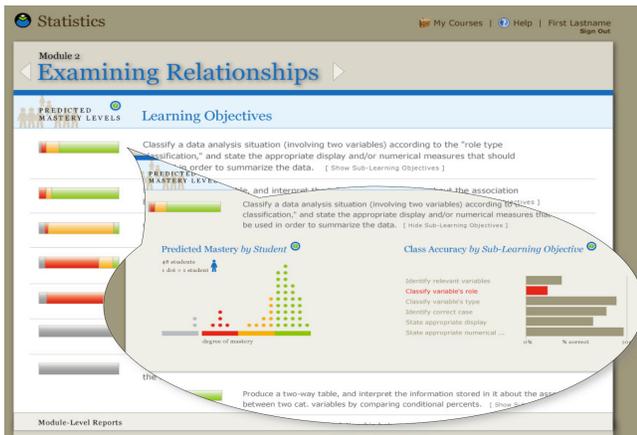


Figure 3: OLI Learning Dashboard for monitoring student performance.

Echo also has built-in analysis tools. One is the ability to perform design audits, in order to maintain quality design and ensure that intended learning analytics will be collected from a given delivery of a course.

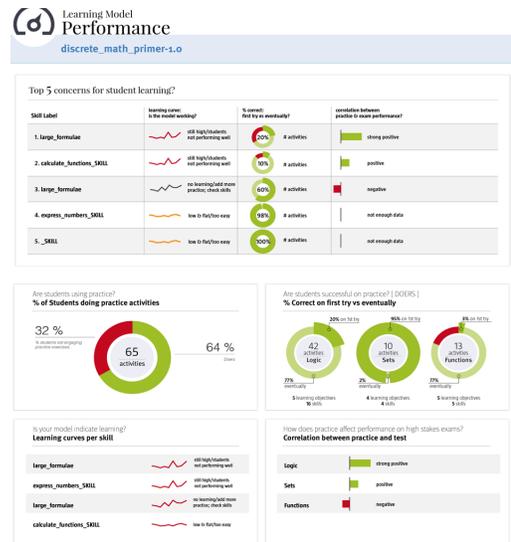


Figure 4: Echo design audit analytics.

OLI and Echo are part of a larger educational technology ecosystem of tools, techniques, content, and code in the OpenSimon Toolkit. The OpenSimon Toolkit offers the ability for any educator to perform the cycle of learning engineering in its entirety toward iterative improvement of content delivered to their students. Other tools in the toolkit include DataShop, LearnSphere, CTAT, Bazaar, and TETRAD to name a few.

The data collected from OLI course delivery can be imported into DataShop and LearnSphere, for example, for performing an array of even more sophisticated data visualizations and analyses, such as Learning Curves Analysis.

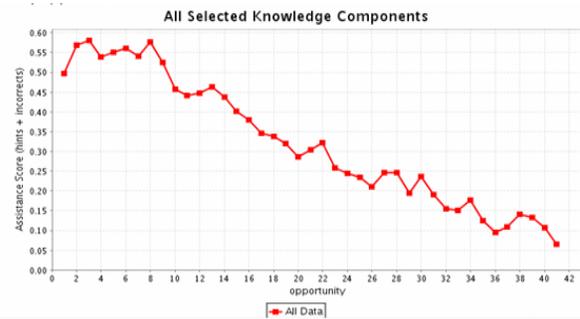


Figure 5: Learning curve analysis visualization from OLI student performance data.

## WHY OLI?

OLI can offer you, as a CS educator, an exceptional collection of openly licensed, complete courseware in computer science topics such as in Programming, Math, and STEM. These courses also have specialty activity types to use in these domains. Echo supports the ability to perform development and customization as an individual or in a team environment. OLI supports larger collaborations in research and development for those seeking to solve educational problems in the CS domain. OLI has close integration with other CMU Simon tools, including tools for data analysis and iterative course improvement, as well as a repository of data for secondary analysis. The OLI team is in the process of bringing together a community of CS course developers and educators to share experiences, activity and development ideas, and find collaborative projects.

## REFERENCES

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