Level up: Video games inspire new 'living textbook' for computational sciences

January 28 2021, by Catharine June

Credit: CC0 Public Domain

A new way of delivering course materials in the computational sciences aims to elevate the study experience from consuming static text and media to a conversation between the learner and the material.

Called Mynerva, the cloud-based interactive textbook platform

developed at the University of Michigan enables instructors to build their materials into video game-like journeys that unfold as the learner progresses.

"Our vision is an interactive computational textbook platform designed to stimulate deeper conversations between students and the material they are attempting to master," said Raj Nadakuditi, professor of electrical and computer engineering at the University of Michigan who sees this as the future of writing computational textbooks. "We also want to enable a dynamic, experiential conversation with the learner, where the material is revealed as the student progresses and is ready for it."

With conventional textbooks, a student may read and view material without fully understanding it, turning the pages without building the expertise that the writer expected them to have by the next chapter. In contrast, the "codex" organization of Mynerva presents the subject matter in a sequence of steps that are punctuated with assessments that the learner must complete.

"Instead of dumping loads of information all at once, a codex nudges the student forward, bit by bit, just at the point when they've shown that they're ready to move on. Through this format, the author is able to be virtually by their students' side through the learning process," said Travis DePrato, who helped develop Mynerva as an undergraduate student in the computer science program. He graduated in December 2019 but continues to work on the project.

The built-in assessments may give immediate feedback, such as a multiple choice quiz, or an autograded programming exercise. Or they may take the form of free responses to open-ended questions—to be assessed by the instructor—that can involve subjective matters such as data exploration. There are many ways for instructors to use their own creativity to organize the material. Authors can hide advanced sections to

avoid discouraging those who are not ready for them—the dragons they cannot yet hope to conquer.

"I think that the aspect of getting to the next question drove some of the gamer in me, that drive to get to the next level," said one student who took an online course that used Mynerva.

Nadakuditi and DePrato believe this format could improve instruction in fields such as data mining, machine learning, autonomous systems, predictions and modeling.

"With Mynerva, you get to create this story for learners to go through and explore the data in really powerful ways that you don't get by just giving them, for example, a PDF or a link to a static web page," DePrato said. "We want to empower instructors to make really powerful interactive content for their students."

Mynerva was initially developed as an extension to the Jupyter Notebook—a format widely used by data scientists for sharing code, results, plots and communicating results to others. But after a few years of building onto that system, it became too cumbersome. They needed to build a new system specific to their interactive textbook needs. Nadakuditi now uses it for all his courses.

Nadakuditi and DePrato are licensing the technology through their new company, Mynerva Inc.

Under the business model, faculty developing course materials are given free access to the platform. They can begin by uploading existing Jupyter Notebooks, and then add interactive quizzes and other functionality offered by Mynerva. The company handles infrastructure, distribution to students and platform updates. The developers expect that most students will pay a subscription fee for access, and the fee will be substantially

less than the cost of a new textbook.

"I hope that Mynerva gives computational instructors the tools to be able to realize the kind of book they always wish they had, but didn't know how to write," Nadakuditi said.

More information: Mynerva: mynerva.io/

Provided by University of Michigan