

Project Title: TheorieLearn: Autograded Resources for Theoretical Computer Science

Team Members	Jeff Erickson (CS), Carl Evans (CS), Yael Gertner (CS), Brad Solomon (CS)
Project Description	We develop resources on the PrairieLearn platform to support the teaching of algorithms, data structures, and other theoretical aspects of computer science, at several different levels of the computer science curriculum. Here at Illinois, our resources have been used by thousands of students in CS 173, CS 225, CS 277, CS 401, CS 403, and especially CS 374; they are also being used at at least half a dozen other institutions. Our development efforts have included significant contributions to the core PrairieLearn infrastructure, and our resources are being used as the foundation of NSF-funded computing education research.
Project Objectives	1. Develop “guided problem sets” and other useful autograded resources for theoretical computer science courses at Illinois and elsewhere. 2. Use these resources both as motivation and tools for computing education research. 3. Make these resources publicly available for computer science educators everywhere.
Major findings/accomplishments during the current funding period (July 1, 2024 to present)	• Erickson is the Illinois PI of a \$1.3M multi-university NSF research grant on computing education, with Geoffrey Herman, Yael Gertner, Diana Franklin (lead PI, U Chicago), Seth Pulsen (Utah State), and Michael Schindler (UC Irvine). The “TheoryABC” project, which officially launched in January, aims to understand how students learn theoretical computer science concepts, and to develop online interventions to support and encourage that learning. TheorieLearn’s resources are the technical backbone of that project. • Our team continued to develop new resources, including new interactive elements and exercises primarily for CS 173, new support for parametrized

	questions in the core PrairieLearn code base, and migration of our automata element to core PrairieLearn. • We have made significant progress toward migrating to a public open-source repository.
Dissemination of work (papers, posters, presentations, etc.--previous or in progress; please provide direct hyperlinks to published work, if possible):	• Eliot W. Robson, Samuel Ruggerio, and Jeff Erickson. FSM Builder: A tool for writing autograded finite automata questions. Proc. 29th ITiCSE, 269–275, 2024. • Hongxuan Chen, Katherine Braught, Geoffrey L. Herman, and Jeff Erickson. Novice difficulties in graph layering for algorithm design. Proc. 56th SIGCSE, v.2, 2025. Poster abstract. Full paper submitted to ICER 2025. • Yael Gertner, Carl Evans, Brad Solomon, Hongxuan Chen, Eliot W. Robson, and Jeff Erickson. Measuring the benefits of an autograded scaffolding tool on students of all levels in an upper level algorithms class. Planned for submission to SIGCSE 2026.
Goals for future (additional objectives, spread of work, etc.):	• Complete transition to a fully public open-source repository, with support tools to help instructors migrate our resources into their PrairieLearn courses • Transition to “community of practice” model for ongoing development and support, supported by department funds (for course development) and external grants (for research activities).
Impact Statement (How has/will this project impact teaching and/ learning in The Grainger College of Engineering and beyond?):	The TheorieLearn project has already had a significant impact on theoretical computer science education at Illinois. Our resources have been used by over 5000 Illinois students, mostly in CS/ECE 374, but also in CS 173, CS 225, CS 227, CS 401, CS 403 and other related courses. Several of our custom elements have been adopted into the core PrairieLearn code base, making them useful to PL users at dozens of other universities, and our course-specific exercises have been adopted by similar courses at UC Irvine, Utah State, U. Chicago, U. Alaska Fairbanks, Saint Louis

	University, U. Montana, and UC San Diego. Project-supported research has been published at major computing and education research venues, and have led to a \$1.3M multi-university collaborative NSF research grant.
Link to “Best of” artifact to illustrate the success of the project (something other than a published paper or poster listed above; student handout, photos, link to course materials, etc.):	https://theorielearn.github.io/

