

Crafting Authentic and Engaging Assignments

Michelle Craig
mcraig@cs.toronto.edu
University of Toronto
Toronto, ON, Canada

Ron Friedman
ron.friedman.ubc@gmail.com
University of British Columbia
Vancouver, BC, Canada

Firas Moosvi
firas.moosvi@ubc.ca
University of British Columbia
Vancouver, BC, Canada

Ben Stephenson
bdstephe@ucalgary.ca
University of Calgary
Calgary, AB, Canada

Steven A. Wolfman
wolf@mail.ubc.ca
University of British Columbia
Vancouver, BC, Canada

Abstract

Assignments are critical to learning but time-consuming for students and instructors. At its best, an assignment helps students achieve learning goals and engages them with authentic problem-solving and with the course, yet remains manageable in terms of student and course staff workload. Unfortunately, these goals may conflict. Authentic and engaging assignments may impose significant cognitive load on students. For course staff, these assessments can be difficult to conceive, develop, and maintain.

In this panel, assignment design experts reflect on how to craft assignments that are authentic and engaging, yet balance these with consideration for student learning and course staff workload. We illustrate with examples of authentic and engaging assignments, focusing on promoting discussion of *designing* new assignments.

CCS Concepts

• **Social and professional topics** → **Student assessment**.

Keywords

context, motivation, assignment design

ACM Reference Format:

Michelle Craig, Ron Friedman, Firas Moosvi, Ben Stephenson, and Steven A. Wolfman. 2025. Crafting Authentic and Engaging Assignments. In *The 27th Western Canadian Conference on Computing Education (WCCCE '25)*, April 28–29, 2025, Calgary, AB, Canada. 2 pages. <https://doi.org/10.60770/g29m-qg95>

1 Introduction

Assignments are critical to computing students' learning. They take a lot of student time to understand and solve, and a lot of staff time to design, deploy, and maintain. For our purposes, an assignment is an assessment that takes a student roughly 1–10 hours and where each student solves the same or a very similar problem to all others. This contrasts with term projects that are generally longer, more open-ended, and more self-directed. Assignments often have at

least three high-level goals: 1) help students achieve a desired set of learning goals, 2) engage students with authentic problem-solving, and 3) increase their engagement with the course material.

In some cases, these elements of assignments may be in harmony. For example, computing students spend a great deal of their “time-on-task” on assignments, and learning cannot happen without effortful practice time [3]. Motivation helps people sustain effortful practice [5], and authentic, engaging assignments can build motivation. Further, some learning outcomes may tie directly to applying problem-solving techniques to authentic problems.

However, these elements may also be in conflict. Rich contexts can raise cognitive load for students, or make “transfer” of learning more challenging than abstract, decontextualized problems [4]. Authentic assignments may increase time-on-task or the complexity of understanding a problem, without any change in motivation or learning [1, 2]. Authentic problems can be difficult to design and time-consuming to adapt. Real-world application can lead to extensive requests for support and clarification from confused students.

How then should educators craft authentic and engaging assignments? We want assignments to motivate students, and we want students to experience authentic applications. Yet, we must balance that with effective learning and efficient design, maintenance, and adaptation for course staff.

Our panelists bring informed and diverse perspectives about authentic and engaging assignment design. We illustrate our ideas with specific examples of awesome, authentic, and engaging assignments. However, our goal is not to disseminate superb assignments but to discuss how to *approach the design* of assignments like these. How do we find ideas for these assignments? How do we fully develop them? How do we plan for manageable support and maintenance? How do we avoid rich contexts obscuring our learning objectives? How do we ensure student time-on-task efficiently contributes to learning? How do we design assignments for reuse, even in the presence of academic misconduct or generative AI?

2 Panel Structure

We begin with three rounds, each with 4 minutes from each of our four panelist groups (45 minutes total):

- (1) Briefly present an engaging and authentic sample assignment and the student response.
- (2) Describe the approaches used in crafting the assignment.
- (3) What are pitfalls in using authentic, engaging assignments?

We then ask the audience to spend 15 minutes in breakout groups discussing the challenges of designing authentic and engaging assignments, specifically answering some of these questions: how do you find compelling domains; how do you balance context and learning objectives; and what fears do you have about using authentic and engaging assignments. Panelists will mingle with breakout groups to facilitate their discussions. We will spend the remaining time reporting back to the whole group from the breakout.

3 Panelist Position Statements

3.1 Michelle Craig

It is tempting to design assignments where the context is rich and complex. In attempting to provide something fun and motivating, instructors may inadvertently create an assignment where a student spends more time understanding the context than the CS concepts. Also, the amount of work a student must invest will depend on their prior familiarity with the context. This is different than their familiarity with the CS concepts. And when familiarity with the context correlates with familiarity with CS concepts, this doubly disadvantages students most in need of support. Finally, the context may contribute to addressing larger program-wide or degree-wide learning outcomes. To make careful decisions in designing assignments, instructors should intentionally consider *all* the learning outcomes and the required background knowledge and learning overhead for the context.

Bio: Michelle has taught undergraduate CS courses (mostly first and second year) for over 30 years. She is passionate about the quality of educational resources and was one of the inaugural Editors for ACM EngageCSEdu steering its transition to a peer-reviewed collection of open-access teaching materials. She has published two Nifty Assignments and conducted research studies on the trade-offs around setting assignments in real-world contexts.

3.2 Ron Friedman and Steven Wolfman

Students are the ultimate arbiters of whether an assignment is engaging and authentic *to them*. This poses daunting challenges: any one context may connect with only a small fraction of students, and which contexts are relevant may shift over time. We are interested in how to expose and track students' interest in contexts and how to streamline a context's "weight". A diverse range of contextualized assignments, tailored to the interests of the student body, has the potential to engage many students and scaffold their understanding of how abstract course concepts apply to real problems.

Bios: Ron is an avid CS student and many-time teaching assistant. Lately, he has been working on designing assignments that are interactive, engaging, and rewarding. Steve has taught 16 distinct courses and 8000+ students. He designs assignments that engage students with authentic contexts, like a forensic accounting problem (a SIGCSE Nifty Assignment); prioritize discovery over confirmation, like a "mystery chip" hardware lab; and tie to hot topics, like probabilistic programming.

3.3 Firas Moosvi

There are many ways to build authentic and engaging assignments; to ensure they remain fresh, diverse, and interesting it is important to incorporate many perspectives. Embedding interesting logical

puzzles that students need to solve and highlighting ethical dilemmas that need to be navigated are two ways to make assignments engaging. The puzzles need to be challenging but not frustrating and the ethical dilemmas should be compelling without detracting from other components of the assignment. Adding reflective components to assignments like this can be a very effective way to gather student feedback directly after students complete the task while things are still fresh in their minds.

Bio: Firas has taught a variety of computer science and data science courses at the undergraduate and graduate levels. He is a strong proponent of open education resources and believes remixing and adapting existing resources is a powerful way to scale up the effort of creating authentic and engaging assignments. His interest in authentic and engaging assessments is mostly focused on creating in-class activities to increase attendance and cultivate intrinsic motivation.

3.4 Ben Stephenson

Time spent crafting engaging assignments is time well-spent. Interesting assignments encourage students to spend time learning, provide a greater sense of accomplishment than decontextualized problems, and often produce something that can be shown to (and appreciated by) non-technical people, which allows the accomplishments to be shared more widely. Including optional "stretch goals" can result in even more impressive software artifacts that help keep highly qualified students engaged, and also provides them with interesting experiences to share when seeking employment.

Bio: Over the past two decades, Ben has designed numerous creative assignments that were intended to better engage his students than decontextualized problems. The success of these assignments has varied, with some receiving only a lukewarm response from students while others have been very well received. Several of Ben's assignments have been published as Nifty Assignments at the SIGCSE Technical Symposium and the Western Canadian Conference on Computing Education.

Acknowledgments

Many thanks to our colleagues, TAs, and students!

References

- [1] John Bacher, Thomas Price, James Skripchuk, Wengran Wang, Yang Shi, and Keith Tran. 2024. Are Engineering Students Motivated by Interacting With Simulations They Program? A Controlled Study. In *Proceedings of the 2024 on ACM Virtual Global Computing Education Conference V. 1* (Virtual Event, NC, USA) (SIGCSE Virtual 2024). Association for Computing Machinery, New York, NY, USA, 19–25. <https://doi.org/10.1145/3649165.3690121>
- [2] Dennis Bouvier, Ellie Lovellette, John Matta, Bedour Alshaigy, Brett A. Becker, Michelle Craig, Jana Jackova, Robert McCartney, Kate Sanders, and Mark Zarb. 2016. Novice Programmers and the Problem Description Effect. In *Proceedings of the 2016 ITiCSE Working Group Reports* (Arequipa, Peru) (ITiCSE '16). Association for Computing Machinery, New York, NY, USA, 103–118. <https://doi.org/10.1145/3024906.3024912>
- [3] K Anders Ericsson, Ralf T Krampe, and Clemens Tesch-Römer. 1993. The role of deliberate practice in the acquisition of expert performance. *Psychological review* 100, 3 (1993), 363.
- [4] Mark Guzdial. 2010. Does contextualized computing education help? *ACM inroads* 1, 4 (2010), 4–6.
- [5] Richard M Ryan and Edward L Deci. 2017. *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford publications.