

Agenda: Concept Inventory Hackathon

The Concept Inventory Hackathon is a collaborative, open-source process for *identifying, measuring and boosting student learning outcomes*. The core goal is to improve students' ability to transfer what they learn in class to solve real-world problems, and to identify and correct student's misconceptions before they get lost.

Facilitator: Chris Lee

1. Introductions (5 minutes)

2. Overview of the strategies and tools used in this hackathon (45 minutes)

During the hackathon, we'll explain how to take small steps requiring minimal time and effort (using online homework problems) that can help you and your students immediately. By leveraging these recommended active learning strategies and tools, you'll be able to empirically collect data on your courses, and boost student learning outcomes.

We'll also introduce a free open-source tool that you can use to monitor students' conceptual understanding and collect data. This tool will give you a window into your student's thinking so you can catch and correct misconceptions when they happen.

3. Work as a group to define target problems (60 minutes)

This is a collaborative activity where we work together to identify concepts and target problems for your specific courses. We'll help you identify one or two concepts that you can work on that follow these characteristics:

- A basic idea that is always true and hence solves a class of problems
- A topic central to your course, i.e. that is relevant to solving a large fraction of real-world problems you want your students to be able to solve once they complete your course
- Concepts students sometimes misuse or misunderstand, i.e. do not reliably think through its implications in different situations

4. Wrap up and next steps (10 minutes)

There is no obligation to do anything further after this meeting.

However, for those who are interested, there will be an opportunity to continue working with this group of faculty both synchronously (video conferencing) and asynchronously to:

- (1) Continue identifying the problems and concepts for your courses
- (2) Collect data with your students using online homework problems
- (3) Share concepts and homework problems with other faculty

Core Definitions

- **Concept:** a concise statement of a principle that is always true, and that furnishes a reliable tool for solving a wide variety of problems.
- **Conceptual understanding:** the ability to think robustly about its implications on a wide variety of different cases and real-world problems, and the ability to use a concept correctly on a wide variety of problems.
- **target problems** define a course's real-world learning outcome goals, as a list of real-world problems we want students to be able to solve after the course. In particular, they must measure *transfer* to the novel real-world problems, i.e. they were *not covered in class*.
- **priority matrix:** unbiased sampling of target problems in the desired area reveals the frequency with which different *concepts* and *mechanics* are needed for solving problems.
- **core concepts:** a concept is "something that is always true" and hence solves a whole class of problems. A core concept is a concept that is needed for solving most problems in a given domain.
- **implicational thinking** is thinking through the implications of a concept in terms of how it applies to the range of possible problems. This is like proving the theorems (implications) of an axiom. This thinking is a *muscle* that we must build through exercise. Developing this thinking ability is even more valuable than its results (if we forget an implication we can figure it out again by *thinking* -- doing this over & over, as a matter of habit, is the only way to truly "know" a subject).
- **ownership** means a student uses a skill for *their own goals* under *their own initiative*, forever (independent of any class telling them to do so).