Creating open computational curricula

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**THE
CARPENTRIES**

Collaborative Notes

shorturl.at/EGHSV

THE CARPENTRIES

A VERY BRIEF HISTORY OF THE CARPENTRIES

software carpentry

DATA CARPENTRY

Library Carpentry

1998

Software Carpentry is founded in 1998 by Greg Wilson and Brent Gorda to teach researchers better software development skills.

2005

Lesson materials are made open source with support from the Python Software Foundation.

2012

Software Carpentry workshop efforts scale with support from the Alfred P. Sloan Foundation and the Mozilla Science Lab.

2013

The first Software Carpentry for Librarians workshops are organized in the US and Canada.

2014

Data Carpentry is founded by Karen Cranston, Hilmar Lapp, Tracy Teal, and Ethan White with support from the National Science Foundation.

James Baker receives support from the Software Sustainability Institute to develop and implement Library Carpentry.

Software Carpentry Foundation is founded under the auspices of NumFOCUS.

2015

Data Carpentry workshop efforts scaled with support from the Gordon and Betty Moore Foundation.

2018

In January, Software Carpentry and Data Carpentry merge to form The Carpentries, a fiscally sponsored project of Community Initiatives.

In November, Library Carpentry joins as a Lesson Program.

python SOFTWARE FOUNDATION · ALFRED P. SLOAN FOUNDATION · mozilla Science Lab · NATIONAL SCIENCE FOUNDATION · Software Sustainability Institute · GORDON AND BETTY MOORE FOUNDATION · NUMFOCUS · COMMUNITY INITIATIVES in service to great ideas
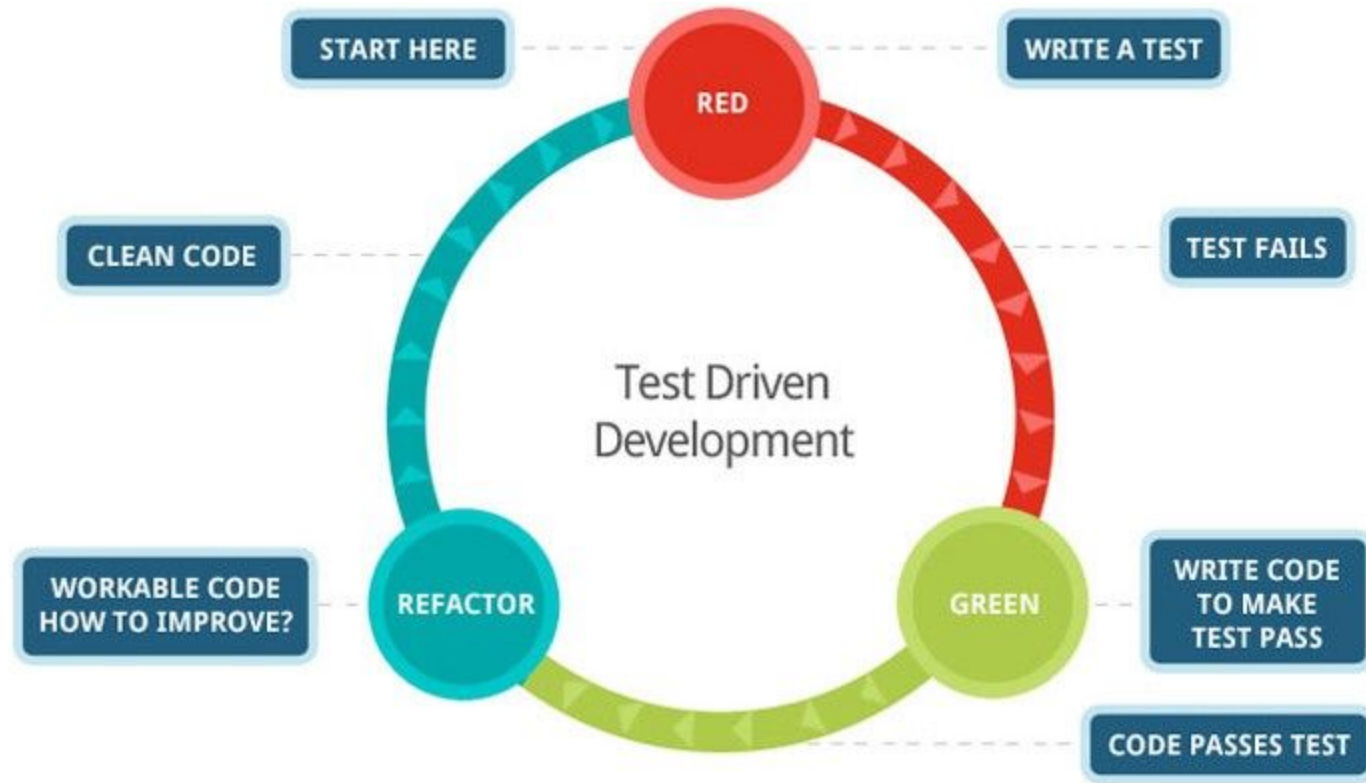
Session Objectives

- Three fundamental aspects of **Backwards Design**:

  - *Identify* **Target Audience**

  - *Define* **Learning Objectives**

  - **Formative Assessment** Strategies

- Feedback

- Important topics we will *not* cover:

  - Lesson Infrastructure
  - Accessibility
  - Community Building
  - Cognitive Load
  - Collaboration
  - Authentic Tasks
  - Example Data

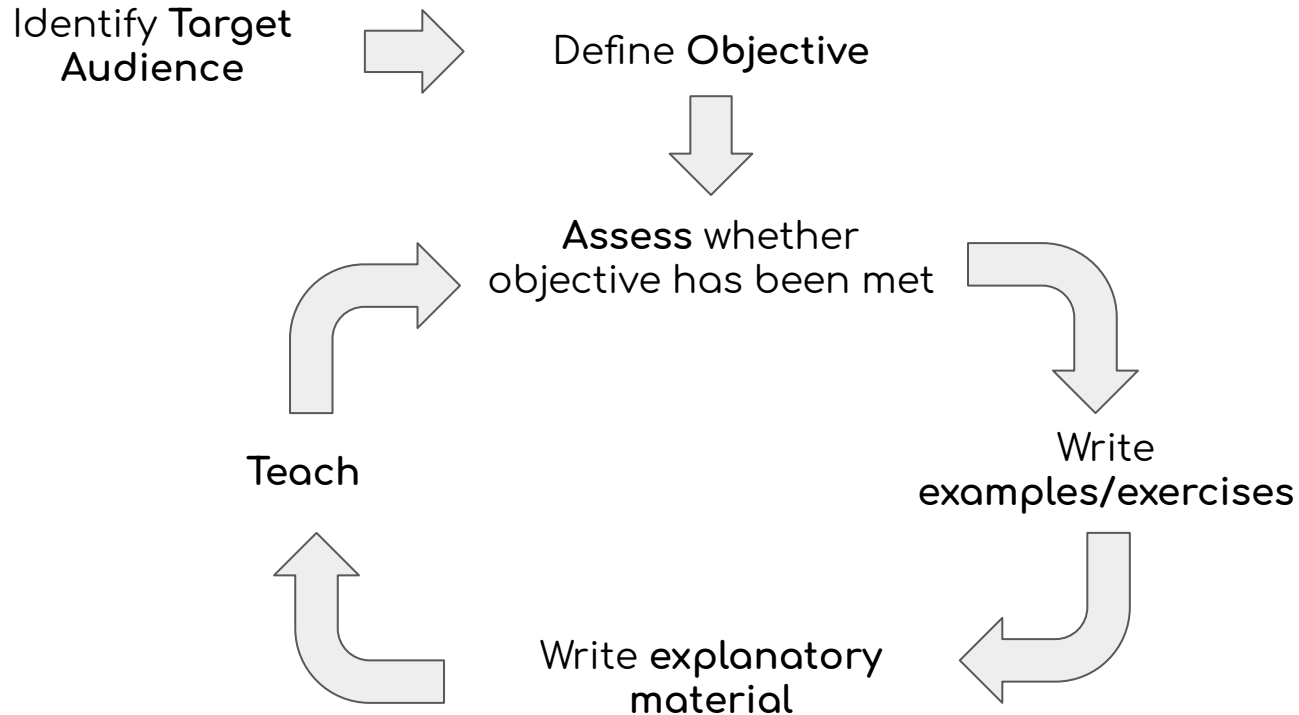Read The Carpentries Curriculum Development Handbook at cdh.carpentries.org

Backwards Design

Backwards Lesson Design

Identify **Target Audience** → Define **Objective**

Define **Objective** ↓

Assess whether objective has been met

Write examples/exercises

Write **explanatory material**

Teach

Target Audience

Take an inventory of your audience

- What is their **background**?

- What is their **motivation**?

- What **prior knowledge** do they possess?

- What **tools** do they already use?
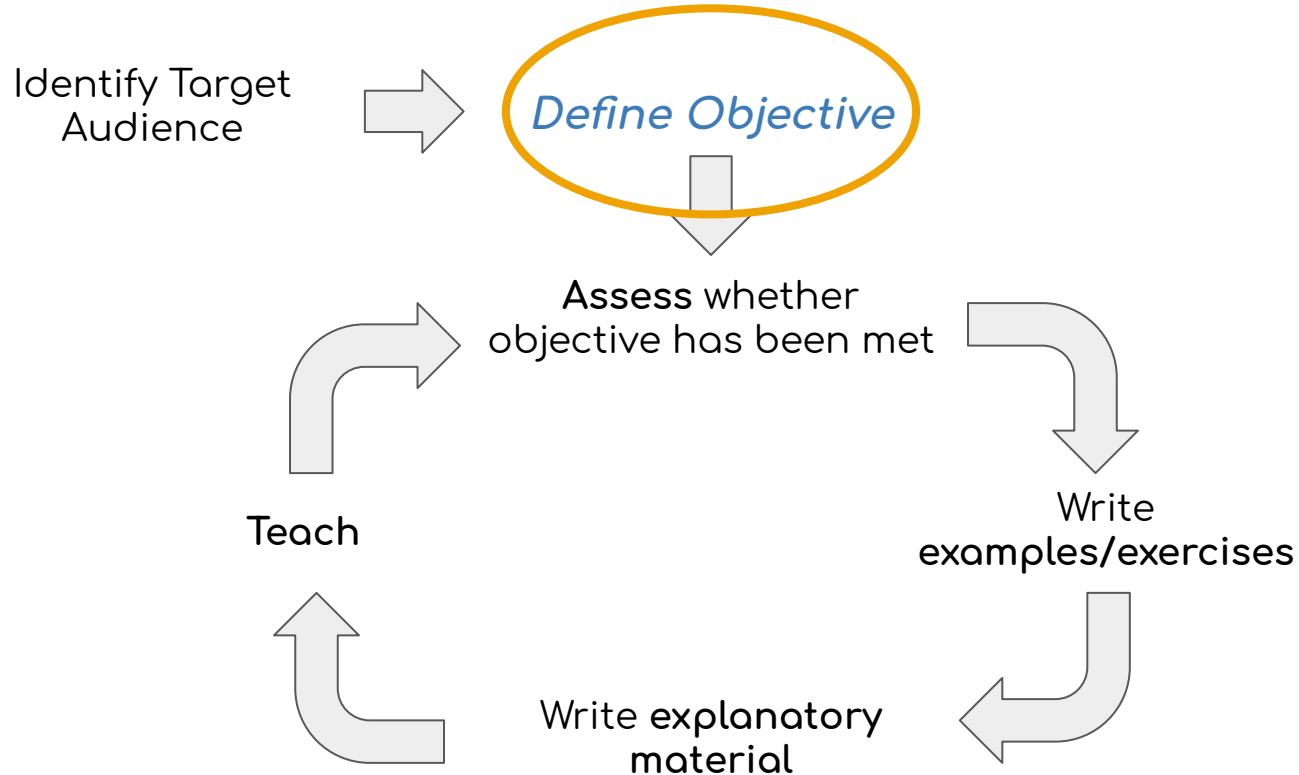
- What types of **data** do they work with?

Example - Learner Profile: João

- **Background:** Agricultural Engineer

- **Prior Experience:** first year programming in C (never used)

- **Motivation:** needs to calculate average values from sensor logs (Data)

- **Tools:** Knows other people in his cohort who use R for their analyses

https://www.onsetcomp.com/images/product_images/large/U9-002.jpg
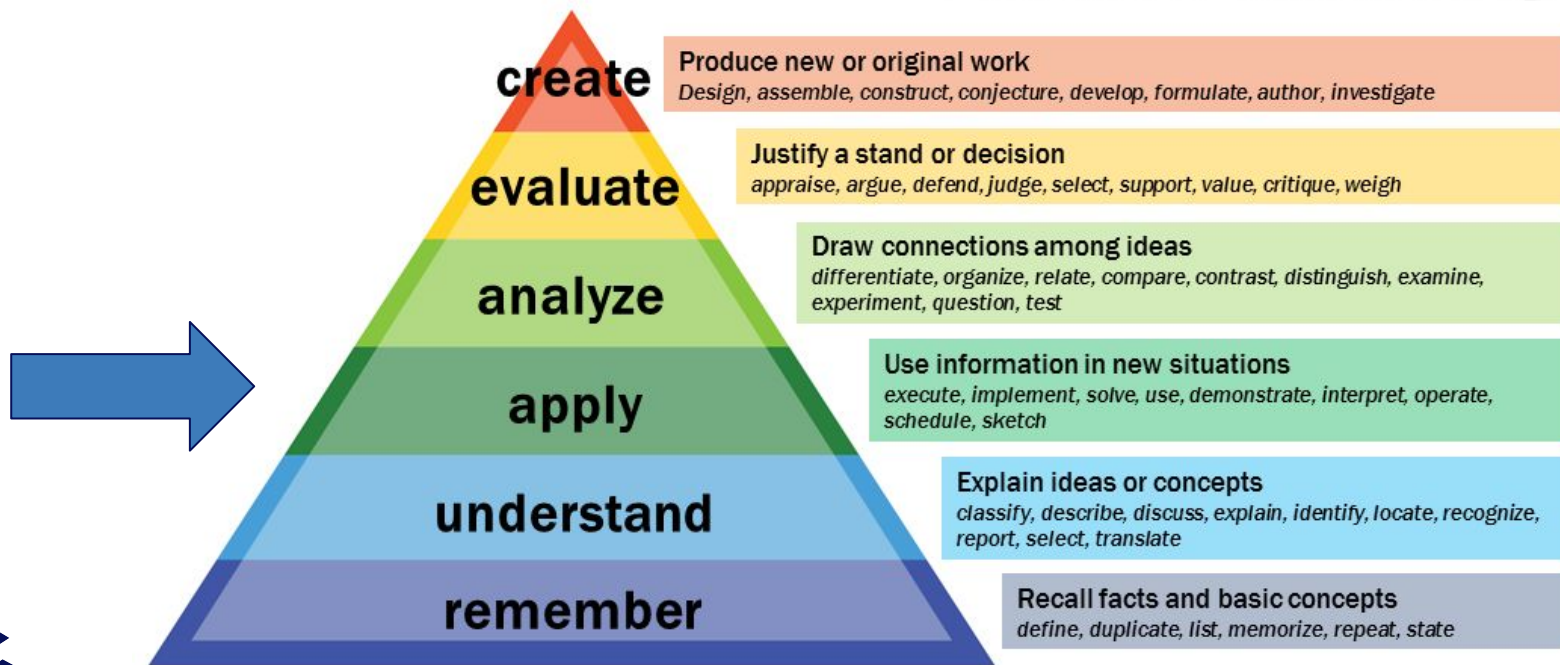
Backwards Lesson Design

Identify Target Audience

Define Objective

Assess whether objective has been met

Write examples/exercises

Write **explanatory material**

Teach

Lesson Objectives

What will learners *be able to do* after the lesson?

Bloom's Taxonomy

create — Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate

evaluate — Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh

analyze — Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

apply — Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

understand — Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

remember — Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

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Example - Learning Objectives

By the end of this section, learners will be able to:

- **Load** external data from a .csv file into a data frame.

- **Describe** what a data frame is.

- **Summarize** the contents of a data frame.

- **Use** indexing to subset specific portions of data frames.

Example taken from the *Starting With Data* section of the *Data Analysis and Visualization in R for Ecologists* Data Carpentry lesson.

Challenge: Identify Your Audience (10 min)

1. Individually, **choose a topic** you would like to teach. Identify and **describe the target audience** for your lesson. (5 min)
   a. Who are they?
   b. What is their motivation?
   c. How will your lesson help them?
2. **Discuss your target audience** with your group (5 min)

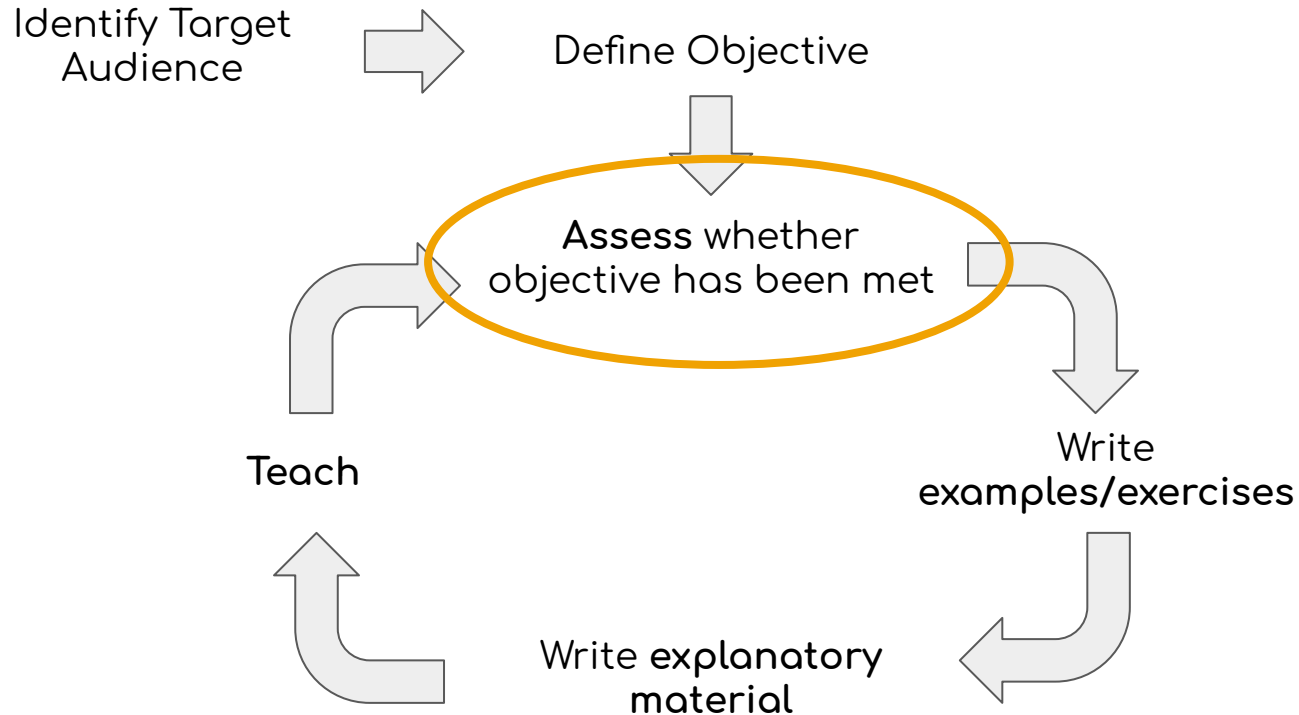HOMEWORK: Define at least two specific learning objectives for your lesson.
   a. Use action verbs like *DEFINE*, *IDENTIFY*, *CHOOSE*, *CREATE*

Feedback & Assessment

Backwards Lesson Design

Identify Target Audience → Define Objective

Assess whether objective has been met

Write examples/exercises

Write explanatory material

Teach

How do you know your teaching is working?

~1 formative assessment per learning objective

Multiple Choice Questions

What will be the output of the Python code below?

```
counts = [2, 4, 6]
repeats = counts * 2
print(repeats)
```

Answer choices:

```
1.   [2, 4, 6, 2, 4, 6]
2.   [4, 8, 12]
3.   [[2, 4, 6],[2, 4, 6]]
```

- Assesses one thing

- Correct answer

- Plausible distractors

- Diagnostic power

  - What are the common misconceptions?

Challenge: Identify Misconceptions (10 min)

What will be the result of the arithmetic operation below?

```
27 + 15
```

Answer choices:

1. 42
2. 32
3. 312
4. 33

1. Choose one wrong answer and **identify the misconception** it diagnoses (individually, 5 mins)

2. **Discuss misconceptions you encounter** in your chosen topic (group, 5 mins)

HOMEWORK: Design an MCQ with plausible distractors for a fundamental concept in your topic.

Feedback and reflective practice

- Collect feedback during and after a workshop
- Reflect on what worked and what did not
- Tell others
- Make changes *now*
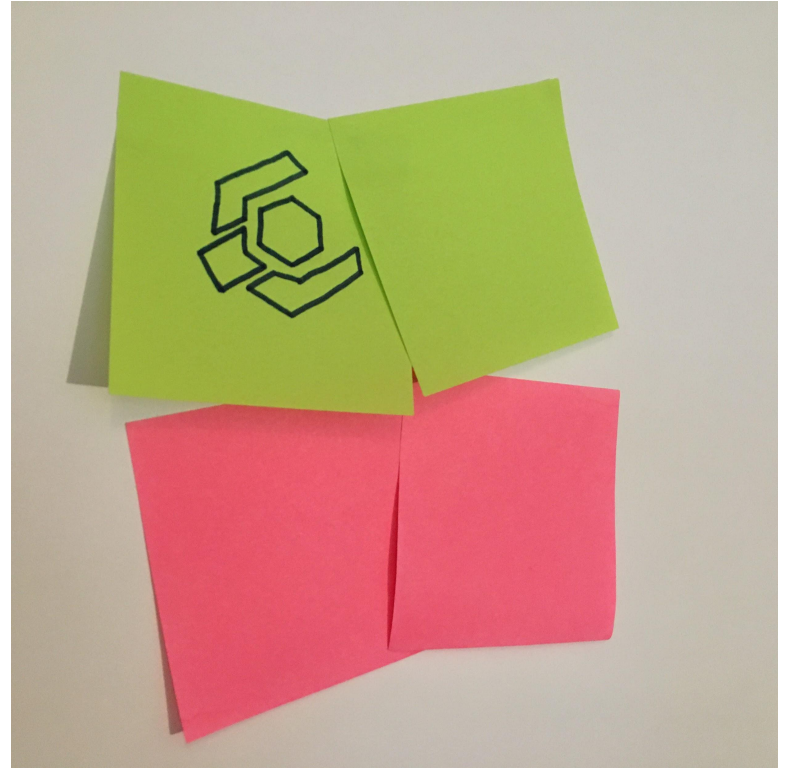
Wrap-up

Creating ==OPEN== computational curricula

- Lesson Infrastructure
  - Free/adaptable lesson template
- Accessibility
  - [Design Principles](#)
- Community Building
  - Instructor Training
  - Community Calls
  - Collaboration
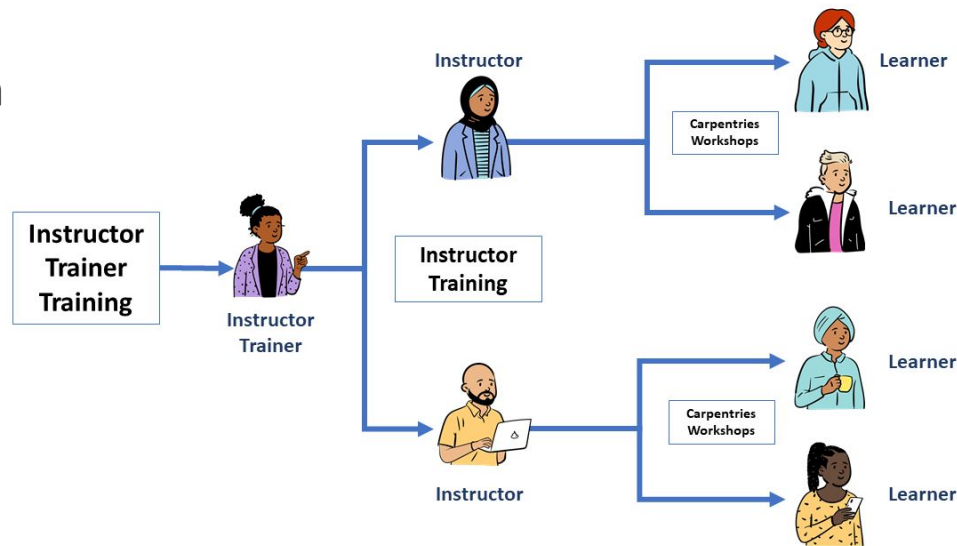- Cognitive Load
  - Teach the most useful thing first

Image credit: Kelly Barnes with [OpenPeeps](#)

Thank You CZI EOSS!

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