

The Carpentries Instructor Training 27-28th August 2024

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Introductions

1. Logistics
 - a. Code of Conduct
 - b. Collaborative document - sign in
 - c. Course material
 - d. Agenda
2. Trainers
3. Participants - icebreaker
4. Workshop goals & motivation

Exercise 1: Knowing Your Audience - Reviewing Your Past Teaching Experience (5 min)

For the multiple choice questions **in the collaborative document**, please place an "X" next to the response(s) that best apply to you. Then find yourself a spot in the shared document below to write a short response to the last question.

A Brief Overview of The Carpentries

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The Carpentries is a **global community of volunteer researchers, instructors, helpers, lesson developers, maintainers, champions and others** oriented around improving basic **computing and data skills for researchers and scientists** through short-format workshops.

Instructor

Co-Instructor and Helpers



Sticky notes

The Carpentries Lesson Programmes

Software Carpentry focuses on helping researchers develop foundational computational skills.

Data Carpentry focuses on helping researchers work effectively with their data through its lifecycle.

Library Carpentry focuses on teaching data skills to people working in library- and information-related roles.

Workshop Overview

1. Learn and apply **research-based teaching principles** (in particular to Carpentry workshops)
2. Understand the importance of a **respectful, inclusive and welcoming classroom** environment
3. Practice and develop **teaching skills**
4. Learn about The **Carpentries history and culture**, and where to go for help in the community

How Learning Works

Building Teaching Skill

Creating a Positive Learning Environment

The Carpentries History and Culture

What We Leave Out

We will not be going over Data Carpentry, Library Carpentry, or Software Carpentry workshop content in detail.

We also do not discuss how to develop lessons, although we do mention some aspects of lesson design.

What Questions Do You Have?

Key Points

1. The **Carpentries is a community of practice**. We strive to provide a **welcoming environment for all learners** and take our Code of Conduct seriously.
2. This episode sets the stage for the entire workshop. The introductions and exercises help everyone begin to **develop a relationship and trust**.
3. This workshop will cover **evidence-based teaching practices** and how they apply specifically to The Carpentries workshops.
4. Learner motivation and prior knowledge vary widely, and can be quickly assessed with a multiple choice question.

Building Skill With Practice



Building Skill With Practice

Questions

- How do people learn?
- How can we help novices become competent practitioners?

Objectives

- Stages of skill acquisition
- Mental models and their links to skill acquisition
- Use a concept map as a visualisation of a mental model
- Understand the limitations of knowledge in the absence of a functional mental model
- Diagnostic tools for broken mental models

The Carpentries Pedagogical Model

We take an applied approach, avoiding the theoretical and general in favor of the **practical** and **specific**.

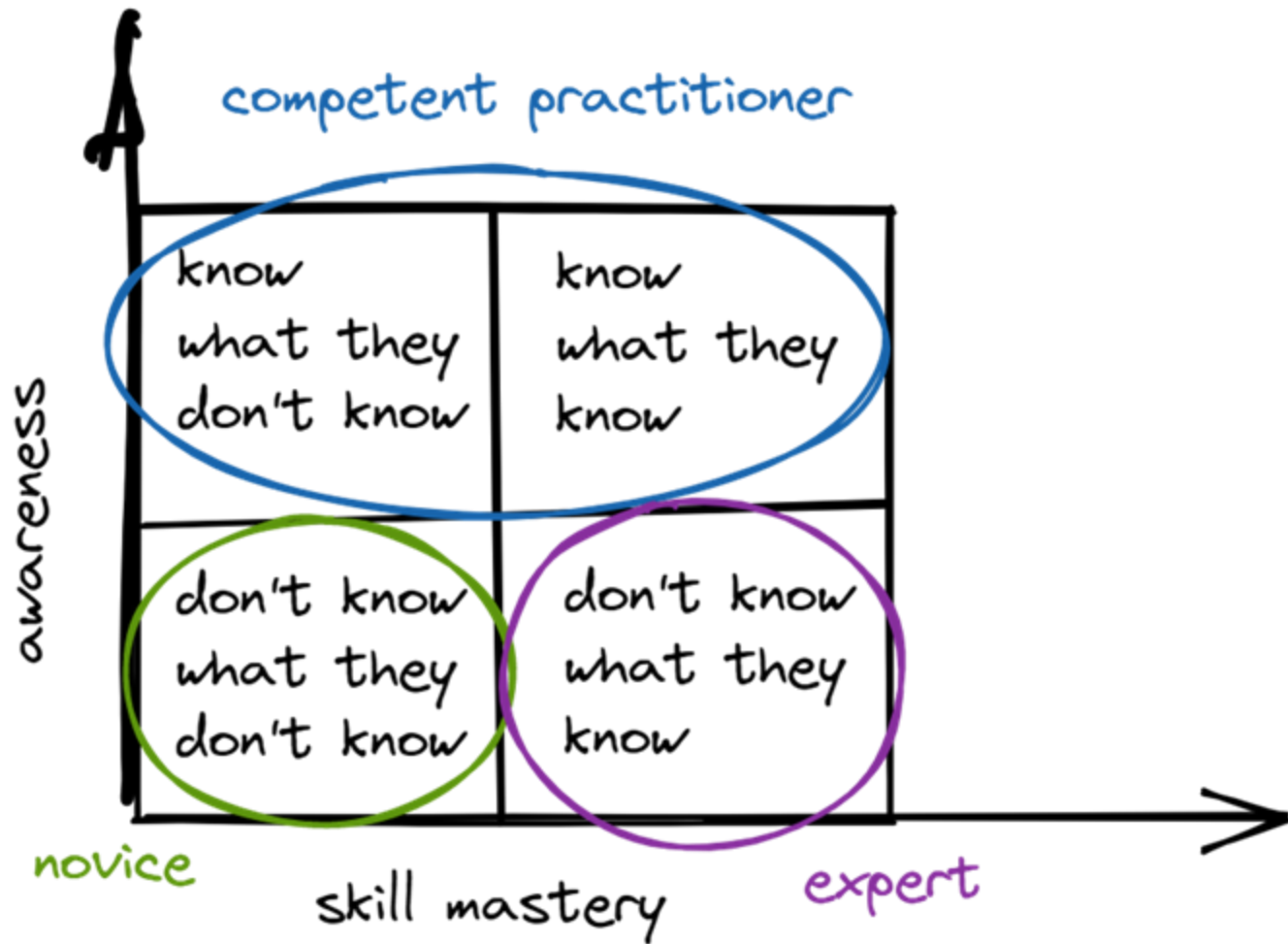
Learners are able to **practice** what they are learning.

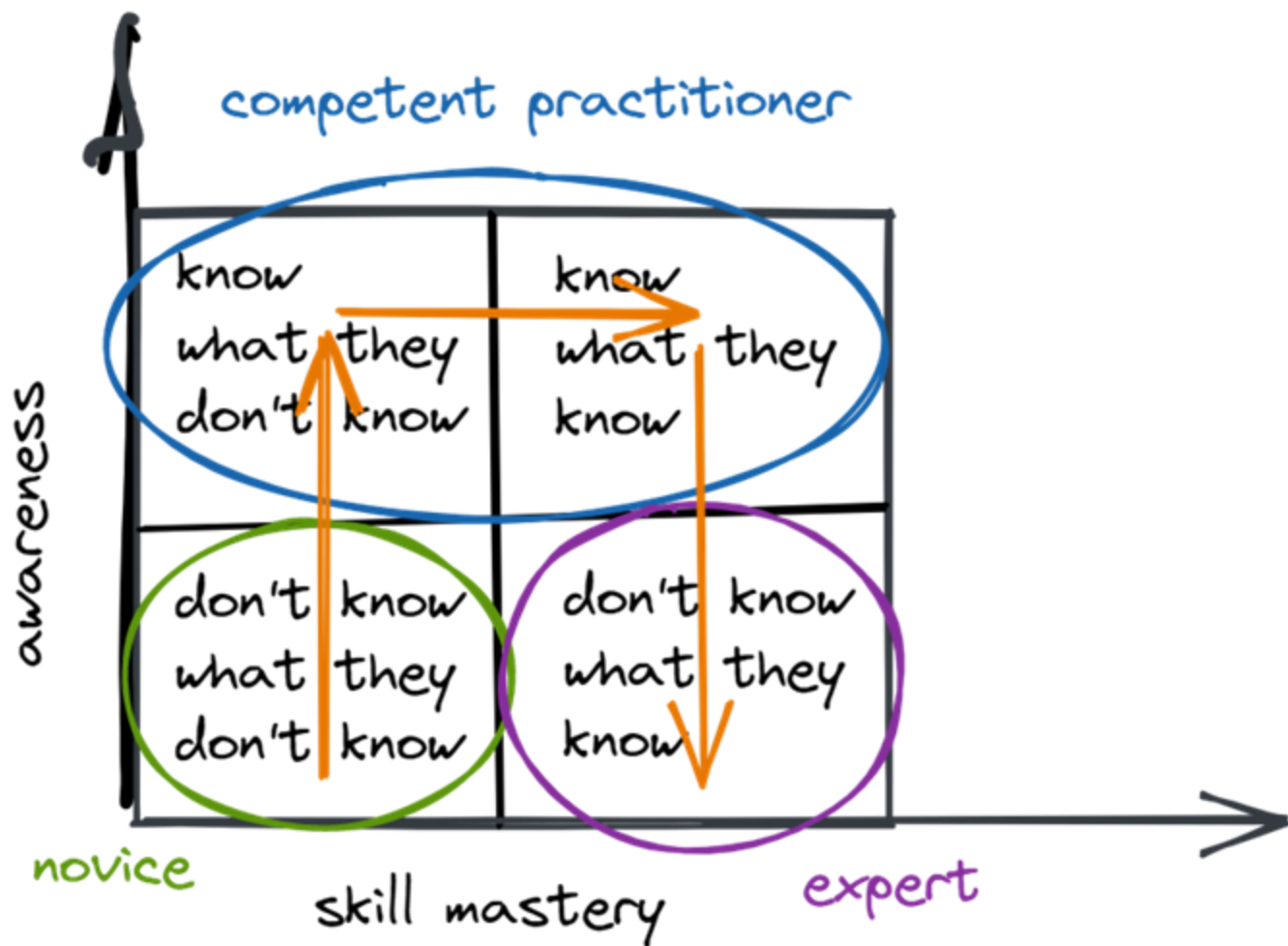
A Carpentries workshop is an **interactive** event – for learners and instructors.

The Acquisition of Skill



Experience level →





The power (and limitations) of analogies

“All models are wrong, but some are useful.”

- George Box, statistician

Analogies (breakouts 10 min)

1. Think of an analogy to explore. Perhaps you have a favorite that relates to your area of professional interest, or a hobby. If you prefer to work with an example, consider this common analogy from education: “teaching is like gardening.”
2. Share your analogy with a partner or group. (If you have not yet done so, be sure to take a moment to introduce yourself, first!) What does your analogy convey about the topic? How is it useful? In what ways is it wrong?

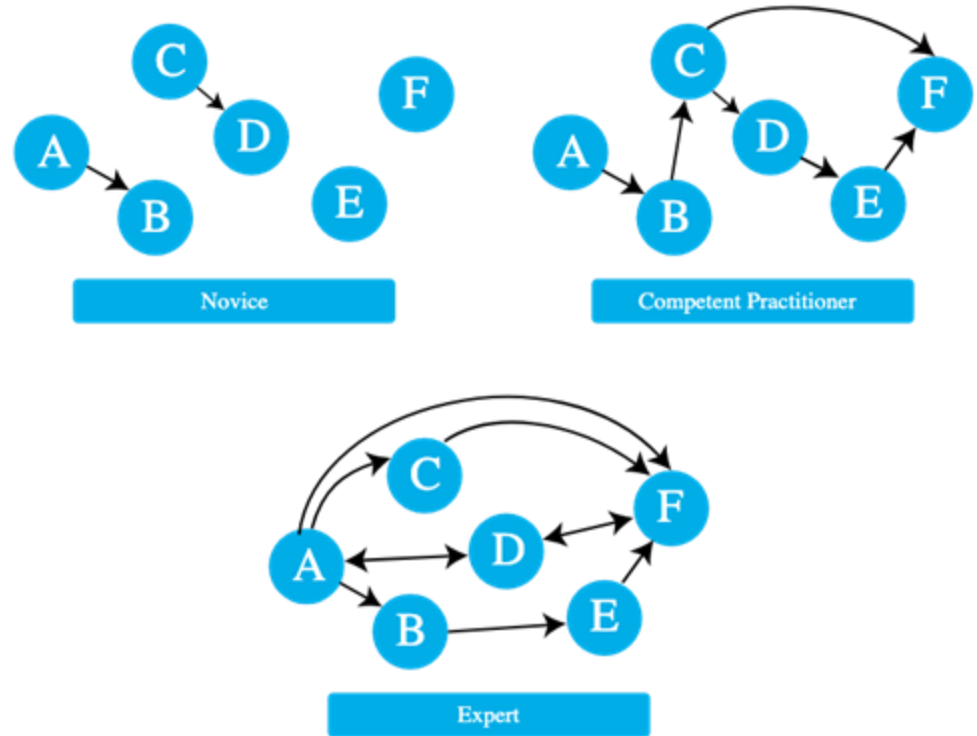
Building a Mental Model

Effective learning is facilitated by creation of a mental model.

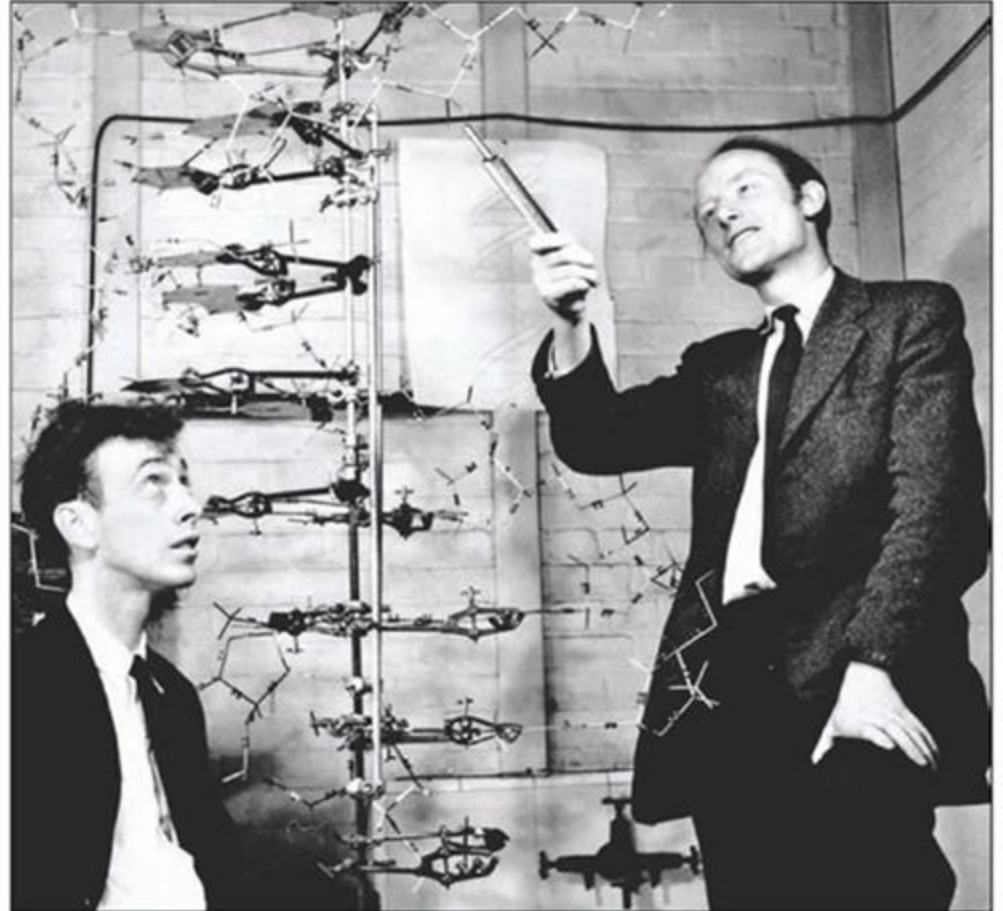
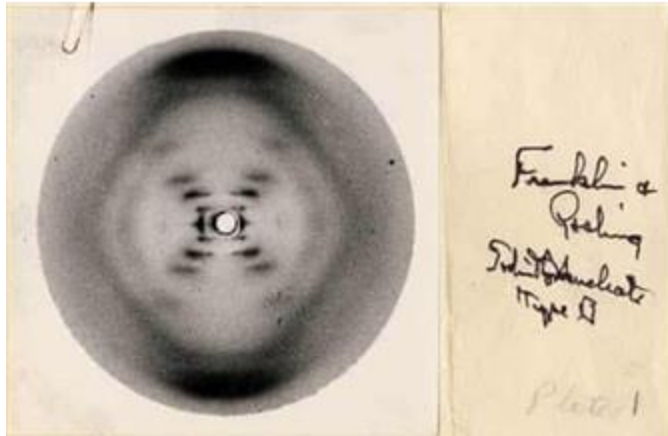
Mental model: a collection of **concepts** and **facts** (about a topic), along with the **relationships** (connections) between those concepts.

Mental Models of Novices vs Competent Practitioners vs Experts

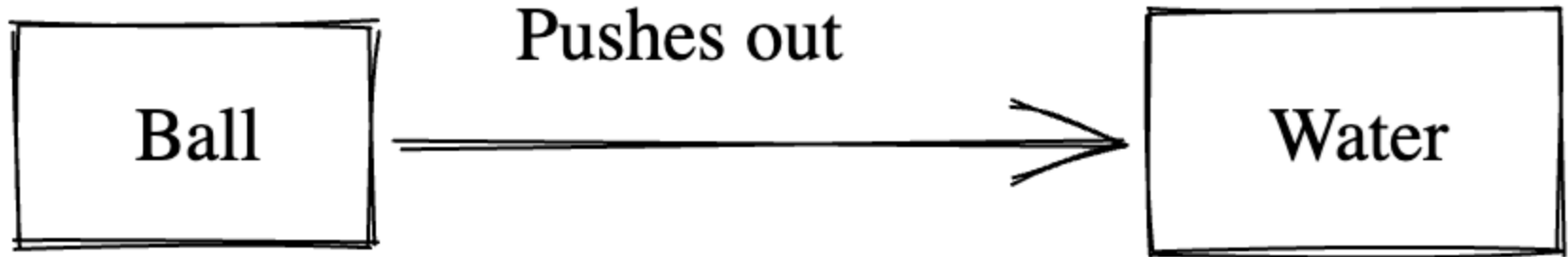
- A mental model may be represented as a collection of concepts and facts, connected by relationships



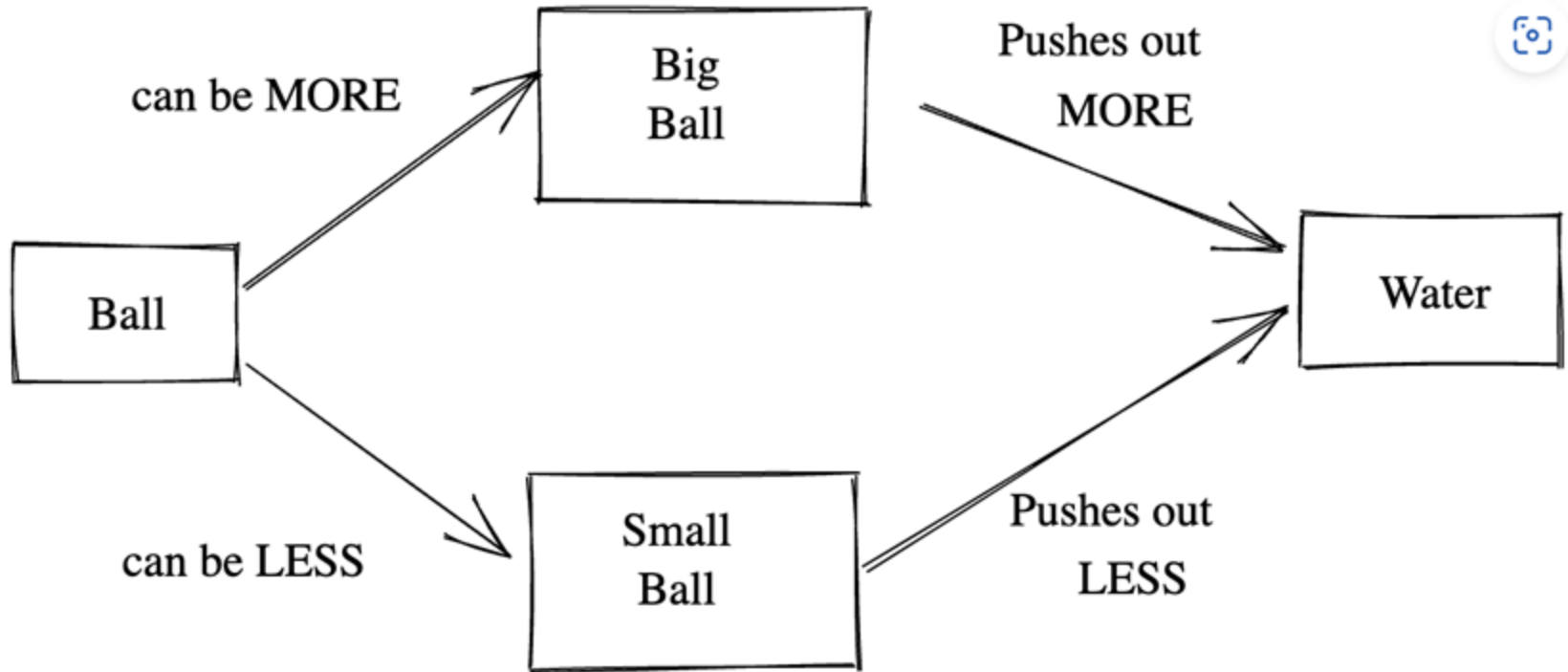
DNA physical & mental model



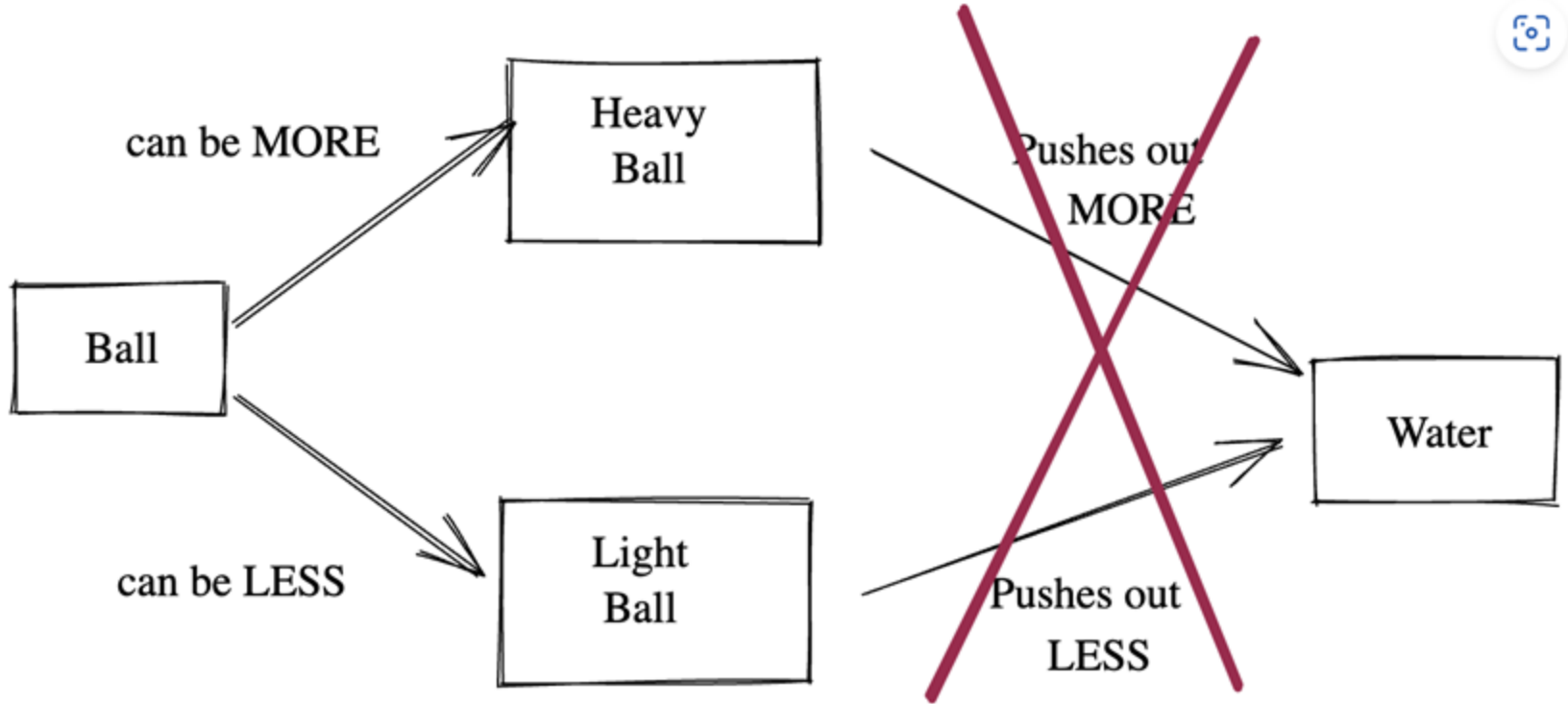
Mapping Mental Models - Concept Maps



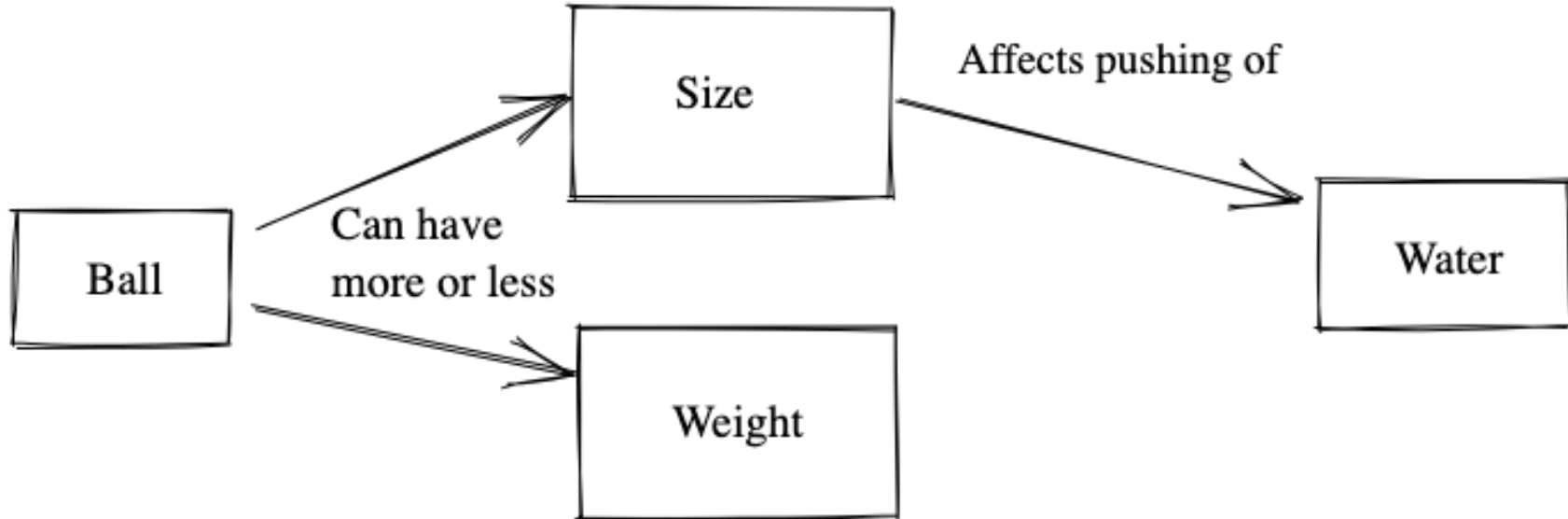
Mapping a Mental Model - cont'd



Misconceptions - Broken Mental Models



Fixing Broken Mental Models



Types of Misconceptions

Simple factual errors

Broken models

Fundamental beliefs

Exercise: Anticipating Misconceptions (5 min)

Describe a misconception you have encountered as a teacher or as a learner.

Using Formative Assessment to Identify Misconceptions

Formative assessment

Takes place during teaching and learning.

Provides guidance to the instructor and the learner about the progress of learning.

No pass or fail - just feedback.

Example: when learning driving, your instructor will give you feedback on, e.g., your parking technique

Summative assessment

Judge when a learner has reached an acceptable level of competence

Either pass or fail

Example: driving exam, when you pass - you get a license.

FORMATIVE SUMMATIVE



WHEN THE **CHEF**
TASTES THE SOUP



WHEN THE **GUESTS**
TASTE THE SOUP

@bryanmalters

FROM STEVE WHEELER'S BLOG "THE AFL TRUTH ABOUT ASSESSMENT"



Exercise: Formative Assessments

Any instructional tool that generates feedback that is used in a formative way can be described as “formative assessment.” Based on your previous educational experience (or even this training so far!) what types of formative assessments do you know about?

Exercise: Multiple Choice Questions

Q: what is $27 + 15$?

- a) 42
- b) 32
- c) 312
- d) 33

The correct answer is 42. Each of the other answers provides valuable insights

Choose one wrong answer and write in the codiMD what misconception is associated with that wrong answer.

Formative assessments are most powerful when ..

All learners are effectively assessed
(not only the most vocal ones!).

An instructor (that's you!) responds promptly to the results of the assessment.

The Importance of Going Slowly

1. Workshop should proceed more slowly than you think
2. Presenting too many facts too soon can actually reinforce an incorrect mental model
3. Help learners construct a working mental model, don't teach them facts.

If someone feels it is too slow, they will be a bit bored. If they feel it is too fast, they will never come back to programming. — Kunal Marwaha, SWC Instructor

Key Points

1. Our goal when teaching novices is to help them construct useful mental models.
2. Exploring our own mental models can help us prepare to convey them.
3. Constructing a useful mental model requires practice and corrective feedback.
4. Formative assessments provide practice for learners and feedback to both learners and instructors.

Coffee Break



Expertise and Instruction



Questions

1. Does subject expertise make someone a great teacher?
2. How are we (as Instructors) different from our learners and how does this impact our teaching?

Objectives

1. Explain what differentiates an expert from a competent practitioner.
2. Describe at least two examples of how expertise can help and hinder effective teaching.
3. Identify strategies for becoming aware of your expert awareness gap.
4. Demonstrate strategies for avoiding dismissive language.

Exercise: What Makes an Expert? (think pair share, 5 min)

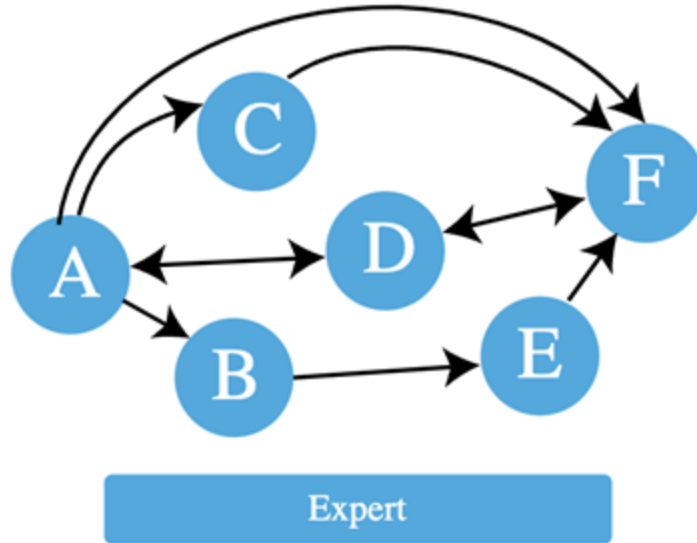
What is something that you are an expert in?

How does your experience when acting as an expert differ from when you are not?

Share with your neighbour.

What Is An Expert?

experts have **more connections** among pieces of knowledge that help them think and problem-solve quickly; more “short-cuts”



Expert can ...

See connections between two topics or ideas that no one else can see

See a single problem in several different ways

Know how to solve a problem, or “what questions to ask”

Jump directly from a problem to its solution because there is a direct link between the two in their mind. Where a competent practitioner would have to reason “A therefore B therefore C therefore F”, the expert can go from A to F in a single step (“A therefore F”).

Mind The Gap - Expert Awareness Gap

Experts are frequently so familiar with their subject that they can no longer imagine what it is like to not understand the world that way. This phenomenon is known in the literature as an *expert blind spot*.

Exercise: Awareness Gaps (silent docing, 5 min)

1. Is there anything you are learning how to do right now?
Can you identify something that you still need to think about, but your teacher can do without thinking about it
2. Think about the area of expertise you identified for yourself earlier. What could a potential awareness gap be?

The background of the image is a close-up of various colorful, 3D letter and symbol magnets scattered across a surface. The surface is divided into two diagonal sections: a light pink section on the top-left and a light blue section on the bottom-right. The magnets are in various colors including yellow, blue, red, orange, and green. They include letters from both the Latin and Cyrillic alphabets, as well as symbols like a plus sign, a question mark, and a hash sign. The magnets are arranged in a seemingly random pattern, with some overlapping. The text "Switching Language" is overlaid in white, bold, sans-serif font, centered horizontally and positioned slightly above the diagonal boundary between the pink and blue sections.

Switching Language

Exercise: What do you use interchangeably? (5 min)

In the Collaborative Document, share an example of words or notation that you sometimes use to accomplish or refer to the same thing. If possible, try to think of an example that might occur in a Carpentries workshop.

Building awareness of how you can represent the same concept in multiple different ways will help you avoid doing so without explanation while teaching.

What Problem?

Experts are also better at diagnosing errors than novices or competent practitioners.

“Just” and Other Dismissive Language

With practice, we can change the way we speak to avoid dismissive language and replace it with more positive and motivating word choices.

Exercise: Changing Your Language (5 min)

1. What other words or phrases, besides “just”, can have the same effect of dismissing the experience of finding a subject difficult or unclear?
2. Propose an alternate phrasing for one of the suggestions above.

Write your examples and alternatives in the Collaborative Document.

“Any Questions?”

instead of “Does anyone have any questions?”

Ask “What questions do you have?”

You Are Not Your Learners

- In most cases a researcher's primary goal is **not to learn programming**, but **to do better and more efficient research**.
- Some researchers have avoided learning programming previously because they believe that the time investment will be excessive and will interfere with their other work.

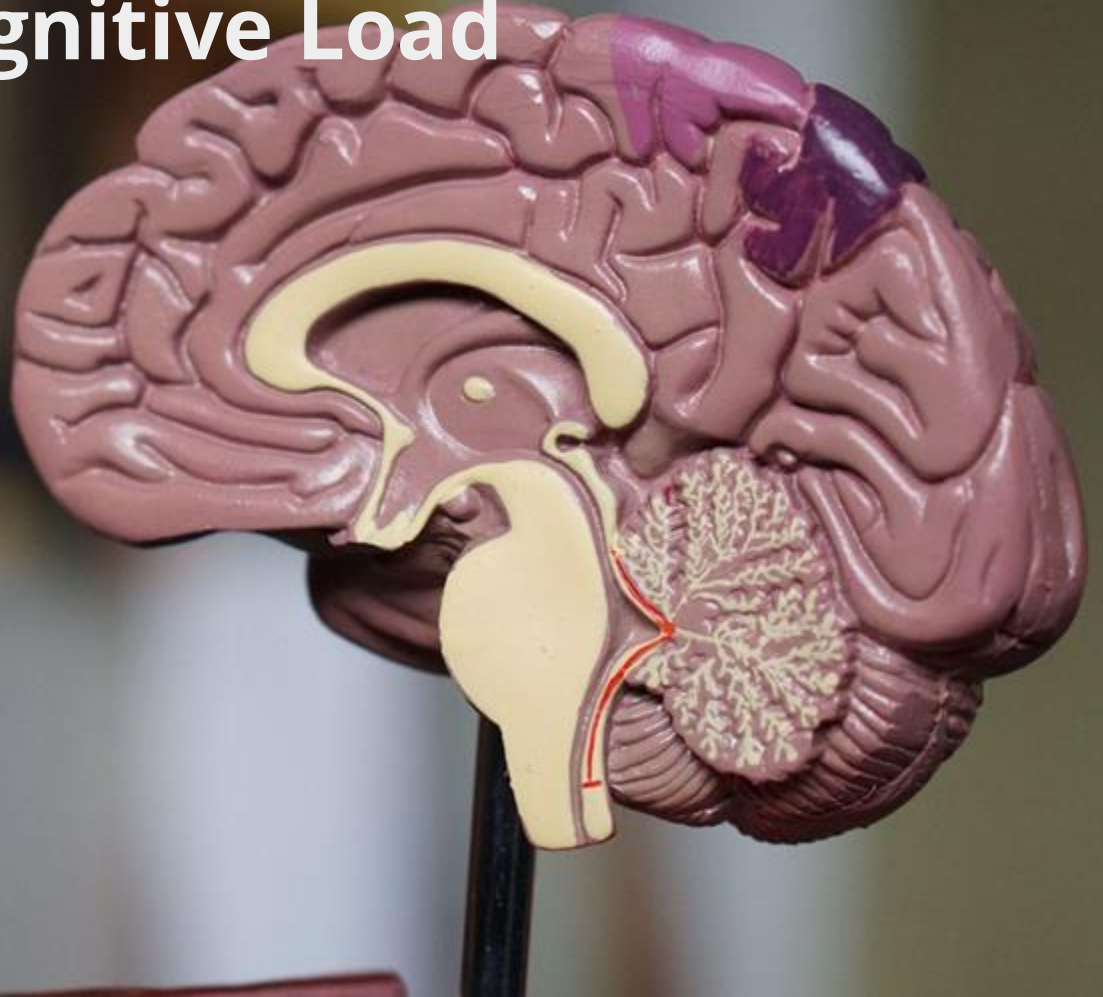
Key Points

1. Experts face challenges when teaching novices due to expert awareness gaps.
2. Things that seem easy to us are often not experienced that way by our learners.
3. With practice, we can develop skills to overcome our expert awareness gaps.

Tea Break



Memory and Cognitive Load



Questions

1. What is cognitive load and how does it affect learning?
2. How can we design instruction to work with, rather than against, memory constraints?

Objectives

1. Remember the quantitative limit of human memory.
2. Distinguish desirable from undesirable cognitive load.
3. Evaluate cognitive load associated with a learning task.

Types of Memory

Short term memory

This is the type of memory you use to actively think about things and is often called working memory. It is much faster, but also much smaller.

Long term memory

It is where we store persistent information like our friends' names and our home address.

Exercise: Test Your Working Memory (5 min)

1. I will read out the list of words.
2. I want you to remember them.
3. When I finish, I want you to write them down somewhere not visible (not in collaborative document).
4. I will read them back to you and we'll see how many you got right.

This website implements a short test of working memory: <https://miku.github.io/activememory/>

Strategies For Memory Management



Chunking

Our minds can store larger numbers of facts in short-term memory by creating chunks, or relationships among separate items, allowing them to be remembered as a single item.

Word CAT is easier to remember than a series of letters C, A, T

Strategies For Memory Management

- Using Formative Assessment to Support Memory Consolidation – exercises to help people test their new knowledge
- Group Work - great opportunity for helpers to circulate
- Opportunities for Reflection - asking learners for feedback or make a concept map
- Limit the number of concepts & don't go into any rabbit holes

Attention is a Limited Resource: Cognitive Load

Memory is not the only cognitive resource that is limited. Attention is constrained as well. 3 things you have to attend when learning:

- Things they have to think about in order to perform a task ("**intrinsic**").
- Mental effort required to connect the task to new and old information ("**germane**").
- Distractions and other mental effort not directly related to performing or learning from the task ("**extraneous**").

Guided practice vs minimal guidance

Minimally-guided instruction requires learners to simultaneously master a domain's factual content AND its search and problem-solving strategies. Fostering creativity and independence takes time. Minimal guidance is intuitively appealing, but that does not mean it always works.

Attention Management in Your Workshop



Using Formative Assessments for Memory Management

Multiple choice exercises

Faded examples: worked examples with targeted details “faded” out
– essentially fill-in-the-blank programming blocks

Parson’s Problems: out-of-order code selection & sorting challenges

Labelling diagrams or flow charts (may also be organized as a fill-in-the-blank)

What to Display?

- we do not recommend displaying Carpentries curriculum materials
- speak commands as they type them on the screen
- use running glossary of commands (in collab doc)

Key Points

1. Most adults can store only a few items in short-term memory for a few seconds before they lose them again.
2. Things seen together are remembered (or mis-remembered) in chunks.
3. Cognitive load should be managed through guided practice to facilitate learning and prevent overload.
4. Formative assessments can help to consolidate learning in long-term memory.

Building Skill With Feedback



Surveys

- pre-workshop survey
- post-workshop survey

Timing Matters

We have found that learners are much more likely to fill out the post-workshop survey while they are still at the workshop than they are after they leave the venue/disconnect from Zoom.

Other ways to collect feedback

- Checking in while teaching (sticky notes / Zoom reactions)
- Minute cards
- One-up, one-down

Example positive prompts

One thing you liked about this section of the workshop

The most important thing you learned today

A new skill, command, or technique you are most excited about using

Example constructive prompts

One thing you did not like or would change about this section of the workshop

One thing that is confusing / you would like clarification on

One question you have

Feedback





Instructor Training day 1 afternoon

Welcome Back

Back
to
School



- Motivation and Demotivation
- Equity, Inclusion and Accessibility
- Teaching is a Skill

Motivation and Demotivation



Motivation and Demotivation

Questions

- Why is motivation important?
- How can we create a motivating environment for learners?

Objectives

- Identify authentic tasks and explain why teaching them is important.
- Develop strategies to avoid demotivating learners.
- Distinguish praise based feedback and the type of mindset it promotes.

Motivation matters

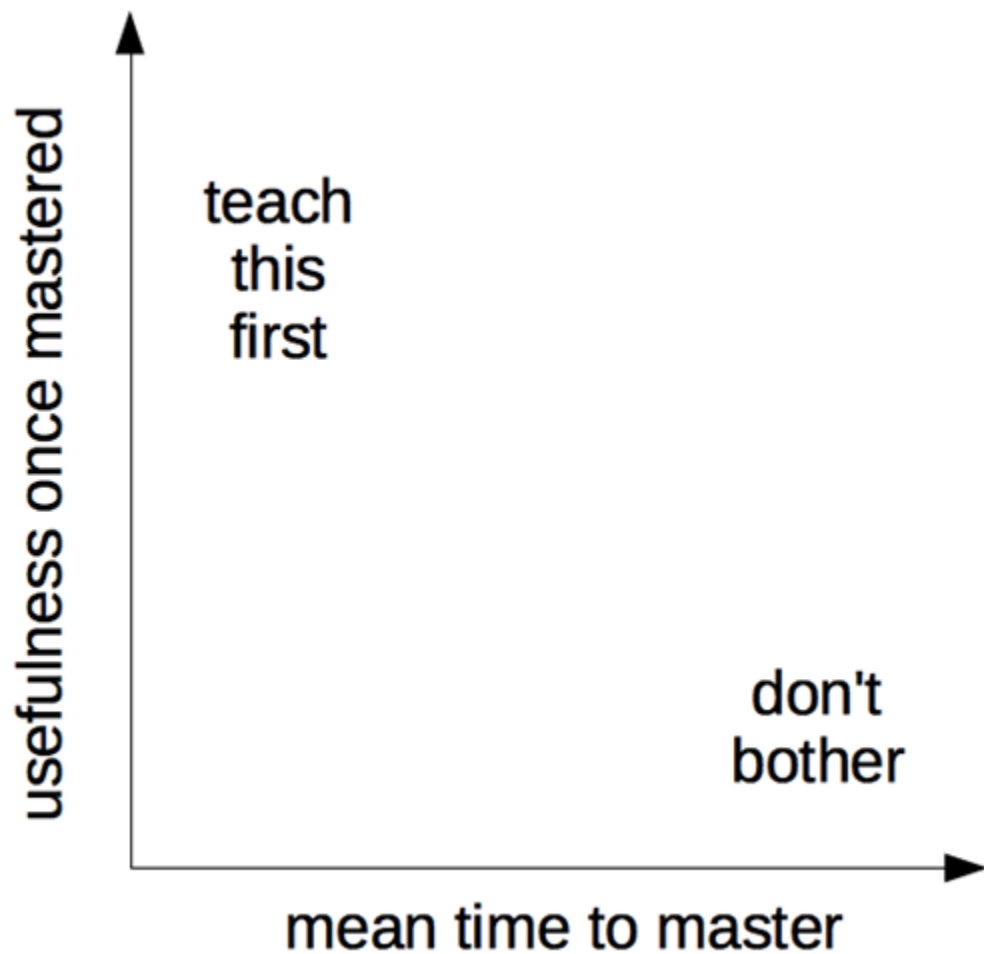
We can do everything to facilitate the cognitive processes needed for learning but it will all fall short if the learners are not motivated.

Big part of our job as instructors is to **cultivate motivation to continued learning.**

How Can Content Influence Motivation?

Motivate learners and help build confidence by starting with:

- what is **quick to learn and immediately useful**
- **authentic tasks** - real tasks performed by someone doing their work



Exercise (10 min, breakout)

Authentic Tasks Think, Pair, Share

Think about some task you did this week that uses one or more of the skills we teach, (e.g. wrote a function, bulk downloaded data, built a plot in R, forked a repo) explain how you would use it (or a simplified version of it) as an exercise or example in class.

In the breakout with your partners and decide where this exercise fits on a graph of “short/long time to master” and “low/high usefulness”.

Actual time

Some tasks may seem easy at the first thought.

Think deeper:

- Is there some underlying work that needs to be done in advance?
- Are you making assumptions without realising due to the expert awareness gap?

Ask your fellow learner. Do they share your estimations?

How Can You Affect Motivation?

Exercise: Brainstorming Motivational Impacts (5min)

Think back to courses you have taken in the past and consider things that an instructor has said or done that you found either motivating or demotivating.

Try to think of one example in each case, and share your example in the collaborative document.

Invite Participation (tips)

- Establishing norms for interaction.
- Encouraging learners to learn from each other.
- Acknowledging when learners are confused.

Encourage a Growth Mindset

Fixed mindset

belief that ability or intelligence is born rather than made.

Growth mindset

belief that ability can be acquired through effort.

Encourage a Growth Mindset

Positive error framing

Encourages learners to understand errors in a positive way – as an opportunity to learn something they would have missed otherwise – **reinforces a growth mindset and helps them to stay motivated.**

Exercise (5 min)

Helping Learners Learn From Mistakes

A learner at your workshop asks for your help with an exercise and shows you their attempt at solving it. You see they've made an error that shows they misunderstand something fundamental about the lesson (for example, in the shell lesson, they forgot to put a space between `ls` and the name of the directory they are looking at). What would you say to the learner?

In the collaborative doc, describe the error your learner has made and how you would respond.

Encourage a Growth Mindset

- Presenting instructor as a learner
- Praising effort or improvement, not performance or ability.

Exercise (5 min) Choosing our Praises

Since we are so used to being praised for our performance, it can be challenging to change the way we praise our learners. Which of these examples of praise do you think are based on performance, effort, or improvement?

1. That's exactly how you do it – you haven't gotten it right yet, but you've tried two different strategies to solve that problem. Keep it up!
2. You're getting to be really good at that. See how it pays to keep at it?
3. Wow, you did that perfectly without any help. Have you thought about taking more computing classes?
4. That was a hard problem. You didn't get the right answer, but look at what you learned trying to solve it!
5. Look at that - you're a natural!

Leveraging the power of “Yet”

A request for help might start with “I can’t ____” or “I don’t understand ____”.

Adding the word “yet” to the end of these sentences helps emphasize that being a novice is a temporary state, and encourages a growth mindset towards progress.

First, do no harm! Things you should not do in your workshop.

- Talk contemptuously or with scorn about any tool or practice.
- Dive into complex or detailed technical discussion.
- Pretend to know more than you do.
- Use the J word (“just”) or other demotivating words.
- Take over the learner’s keyboard.
- Express surprise at unawareness.

"no feigning surprise"

my ♥ favourite ♥ social rule from the
🖥️ Recurse Center 🖥️

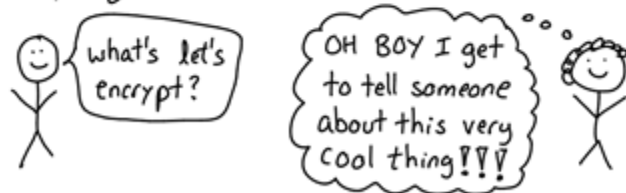
Here's a thing that happens a lot:



Here's a cool simple trick!

Don't act surprised when someone doesn't know something you thought they knew
(even if you are a little surprised!)
It doesn't help.

Then you get to have fun times like this:



And it gets easier with practice! ☺☺☺

Julia Evans
[@b0rk](https://twitter.com/b0rk)

Not Just Learners

- Learners respond to an instructor's enthusiasm.
- Instructors are learning to teach (that requires motivation as well).
- Carpentries Instructors teach because they want to.

Exercise (5 min) Why Do You Teach?

We all have a different motivation for teaching, and that is a really good thing! The Carpentries wants instructors with diverse backgrounds because you each bring something unique to our community.

What motivates you to teach? Write a short explanation of what motivates you to teach. Save this as part of your teaching philosophy for future reference.

Key Points

- A positive learning environment helps people concentrate on learning.
- People learn best when they see the utility in what they're learning and believe it can be accomplished with reasonable effort.
- Encouraging participation and embracing errors helps learners to stay motivated.

Equity, Inclusion, and Accessibility

Questions

- Why are equity, inclusion, and accessibility important?
- What can I do enhance equity, inclusion, and accessibility in my workshop?

Objectives

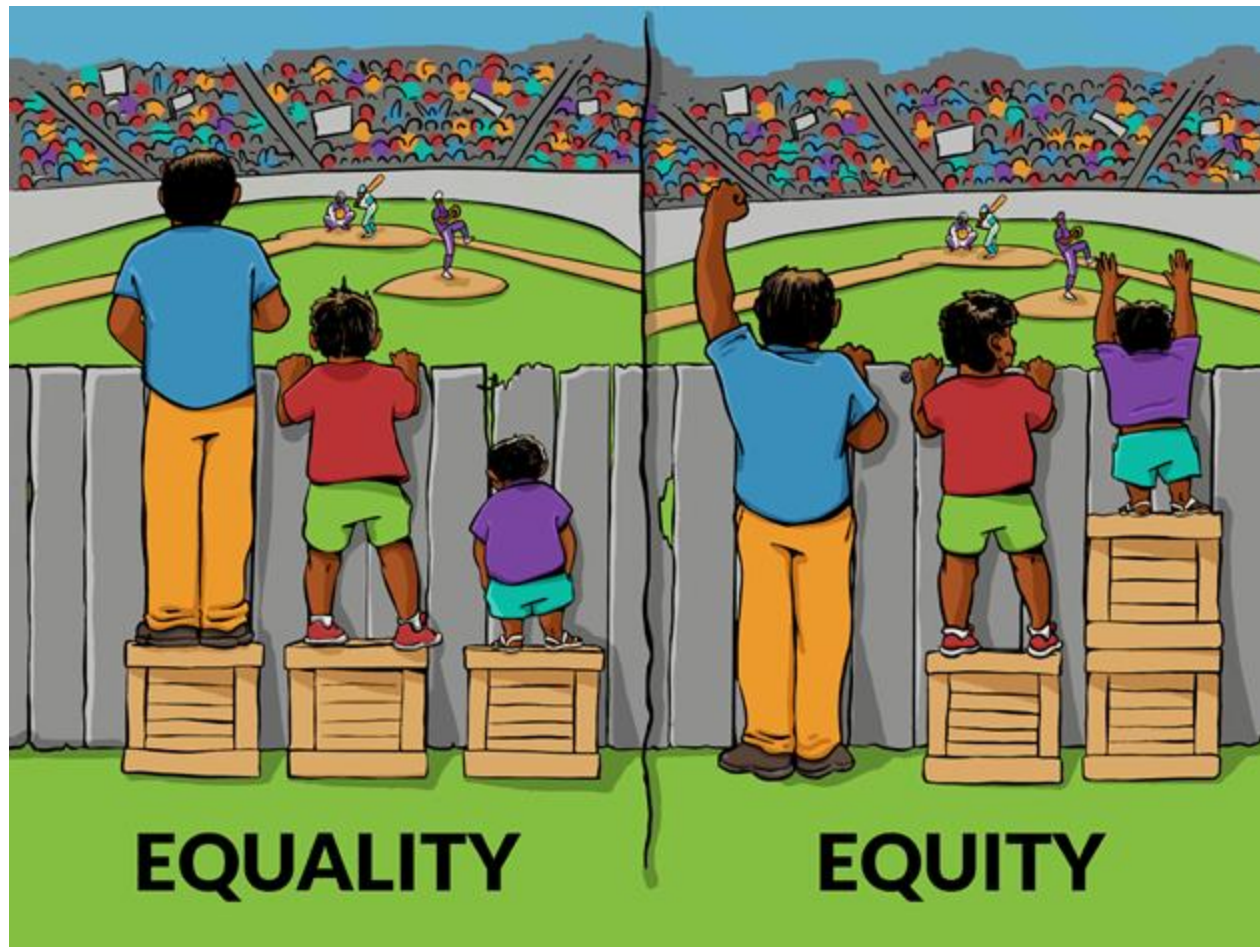
- Identify instructional strategies that are consistent with universal design.
- Recognize systemic factors that can distract and demotivate learners.
- Understand the role of The Carpentries Code of Conduct in maintaining an explicitly inclusive environment.

Equity, Inclusion, and Accessibility

Equity

The proportional distribution of desirable outcomes across groups.

Sometimes confused with equality, equity refers to outcomes while equality connotes equal treatment.



Inclusion

Actively engaging traditionally excluded individuals and/or groups in processes, activities and decisions in a way that shares power.

Inclusion promotes broad engagement, shared participation, and advances authentic sense of belonging through safe, positive, and nurturing environments.

Accessibility

Refers to the intentional design or redesign of technology, policies, products, and services that increase one's ability to use, access, and obtain the respective item.

Each person is afforded the opportunity to acquire the same information, engage in the same interactions, and enjoy the same services in an equally effective and equally integrated manner, with substantially equivalent ease of use.

Exercise (5 min): What Happens When Accessibility is an Issue?

Think of a time when you have been affected by, or noticed someone else being affected by barriers to accessibility.

This may have been at a conference you attended where the elevator was out of service, or maybe a class you were taking relied on audio delivery of content.

Describe what happened, how it impacted your (or someone else's) ability to be involved and what could have been done to provide better accessibility in this case.

Accessibility

When organising a workshop, think of accessibility in advance, don't wait for participants to tell you about their needs.

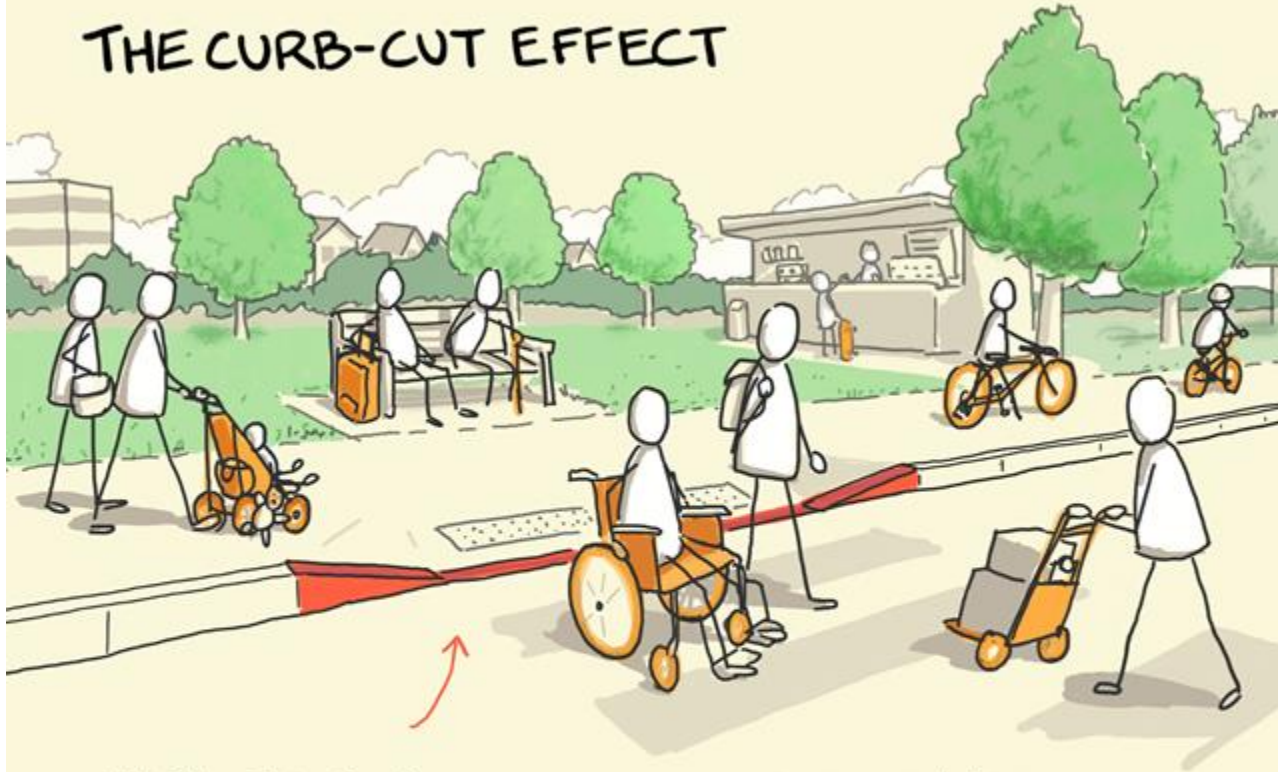
Many people will not feel comfortable requesting accommodations in advance.

From Accommodation to Universal Design

Accommodation puts the burden on the individual with the need.

By contrast, **universal design** means creating something to be maximally usable by all people (or as many as possible) without additional changes.

THE CURB-CUT EFFECT



WHEN WE DESIGN
FOR DISABILITIES

... WE MAKE THINGS
BETTER FOR EVERYONE

sketchplanations

Every little bit counts

It can be overwhelming so ...

- Don't try to do everything at once.
- Do the easy things first.
- Introduce one thing at a time.
- Don't be hard on yourself (take the growth mindset approach).

The Carpentries Accessibility Checklist

If you're worried you'll forget about something - check out in the **accessibility checklist** in the Carpentries Handbook.

In time, grow your own checklist based on experience.

Systemic exclusion

Members of certain groups often carry a heavier load due to systemic forces that disproportionately impact them.

As with other demotivation pitfalls, we can also think carefully about the language that we use and how we interact with our learners to avoid reinforcing systemic bias.

Stereotypes

- may be **explicit** (conscious and deliberate) or **implicit** (unconscious and automatic)
- **guide what we notice** about people
- **guide how we interpret** people's behaviours
- can **facilitate quick judgements** in appropriate situations (e.g. stopping a child from driving a car)
- can **lead to systematically negative attitudes and behaviours** towards members of certain groups

What can we do about our own stereotypes

- Get to know people from many different groups
- Observe your own behavior, and build awareness of situations in which your perceptions and behaviors are influenced by stereotypes
- Avoid calling attention to common stereotypes, even in a way that seems positive

Inclusive Practices in a Carpentries Workshop

- Setting expectations with the Code of Conduct
- Listening with assessment and feedback
- Examining your actions and language

Key Points

- Inclusivity is a key attribute of a positive learning environment
- Universal design benefits everyone

Coffee Break



Teaching is a skill

Questions

How can I improve my teaching?

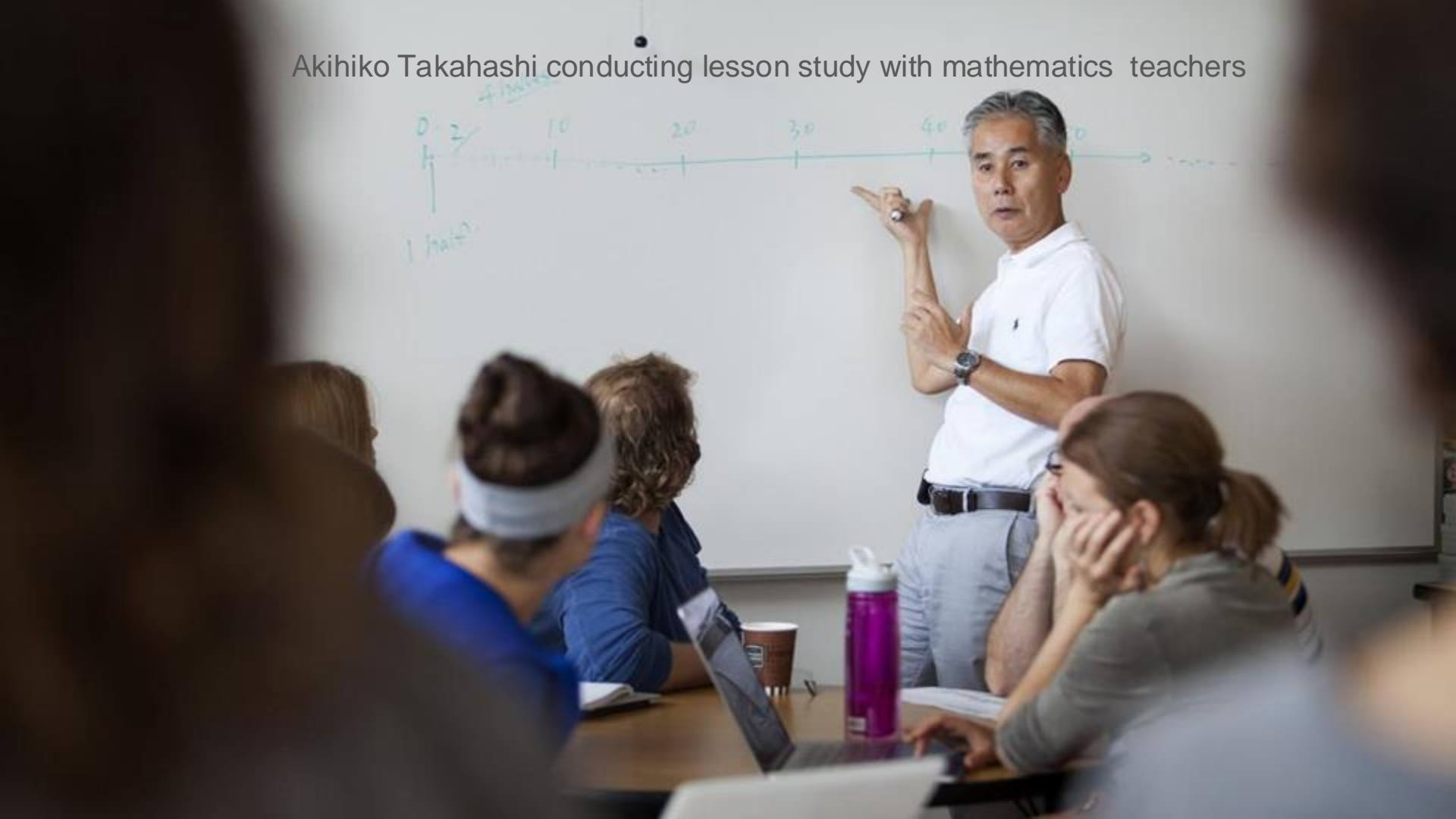
Objectives

Use peer-to-peer lesson practice to transform your instruction.

Give thoughtful and useful feedback.

Incorporate feedback into your teaching practices.

Akihiko Takahashi conducting lesson study with mathematics teachers



Lesson Study

jugyokenkyu

Feedback is hard



Initiate feedback

What kind of feedback are you looking for? Ask Questions.

“What is one thing I could have done as an instructor to make this lesson more effective?”

“If you could pick one thing from the lesson to go over again, what would it be?”

Balance

What to improve / What went well

Tip / Top

Communicate expectations

How learners / other instructors can best communicate their feedback to you?

Use feedback translator

Someone (co-instructor) who can communicate collected feedback.



Tips for giving feedback

- Be positive.
- Be specific
- Provide next steps
(actionable)

Remember that giving and receiving
feedback is a skill

You need feedback on feedback

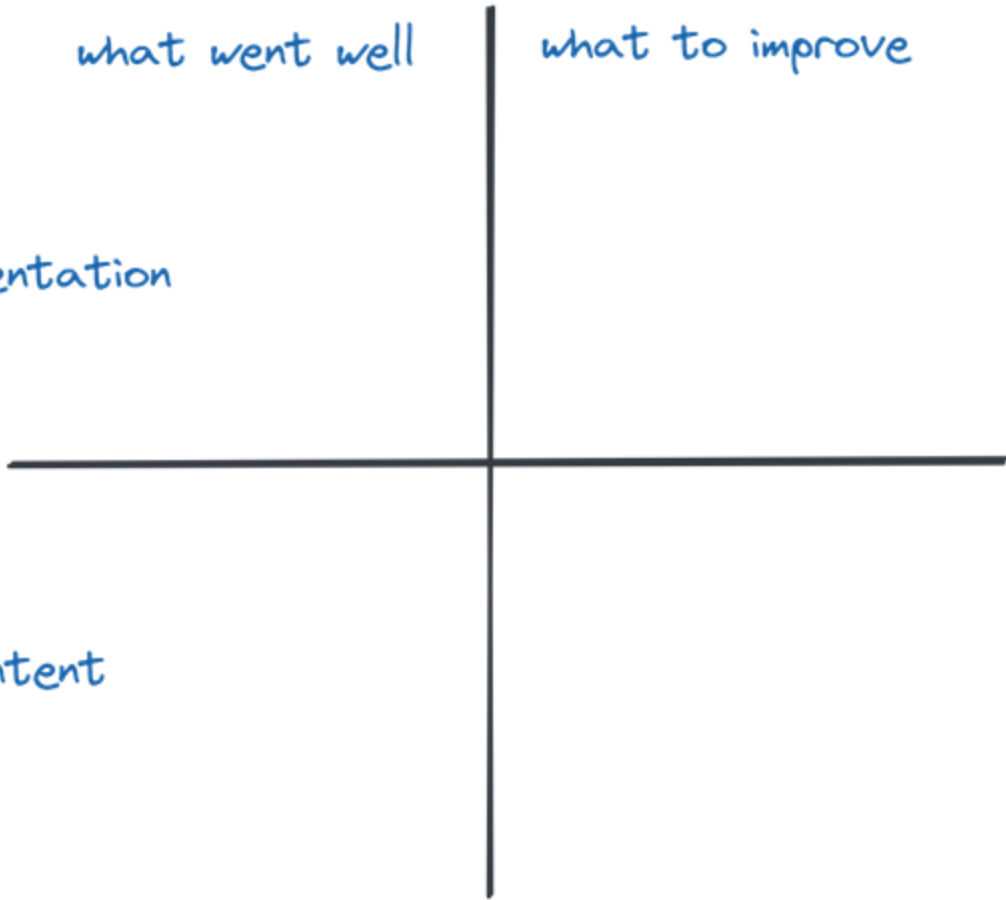
You need to practice

what went well

what to improve

presentation

content



Exercise (10 min)

We will start by observing some examples of teaching and providing some feedback.

Watch example teaching video and then give feedback on it.

Put your feedback in the collaborative document.

Organize your feedback along two axes: positive vs. opportunities for growth (sometimes called “negative”) and content (what was said) vs. presentation (how it was said).

Exercise: Sharing Feedback (breakouts ~20 min)

You will be split into breakout rooms with the groups of three.

Individually, spend 5 minutes preparing a 90-second introduction to the topic of the lesson episode you chose before the start of the training course. You will not be live coding.

Get together with your group and have one person teach their segment to the group. Keep a strict time limit of 90 seconds per person (one person should be responsible for the timekeeping).

After the first person has finished teaching, share feedback. The person who performed should start by offering feedback on themselves. The timekeeper should help to keep feedback to about 5 minutes per person to ensure everyone has time to perform and discuss.

Rotate roles and repeat.

Return to the main group and briefly summarize the feedback you received in the Collaborative Document.

Key Points

Like all other skills, good teaching requires practice and feedback.

Lesson study is essential to transferring skills among teachers.

Feedback is most effective when those involved share ground rules and expectations.

Homework

The background is a blurred photograph of a desk. In the upper left, a dark laptop is visible. To its right is a silver mesh pen holder containing several pens. In the foreground, a spiral-bound notebook is open, with a pink paper clip on the left page and a small jar of green and white patterned tape in the center. To the right of the notebook is a white computer mouse. A small, colorful, rectangular object, possibly a sticky note or a small calendar, is also visible on the desk.

Homework

Read about centrally-organized and self-organized workshops and our handbook content on Teaching and Hosting Workshops – be sure to click through to some of the associated checklists.

Prepare for the live coding exercises.

Exercise: Using Feedback (5 min)

Look back at the feedback you received on your teaching. How do you feel about this feedback? Is it fair and reasonable? Do you agree with it?

Identify at least one specific change you will make to your teaching based on this feedback. Describe your change in the Collaborative Document.



Instructor Training Day 2

Welcome Back

Warmup: What you learned yesterday?

One (favourite) thing (concept, idea, theory) you remember from yesterday.

Day 2 morning

Getting Started on Instructor Certification

The Carpentries: How We Operate

Live coding is a skill

Preparing to teach

Exercise: What questions do you have? (5 min)

Yesterday we asked you to read some resources about the logistics of teaching and running Carpentries workshops.

Please add your questions about logistics and preparation to the Collaborative Document.

We will answer these questions in the Collaborative Document during your work time and will return to this list later today.

Getting Started on Instructor Certification

Questions

What do I need to do to finish certifying as a Carpentries Instructor?

Objectives

Describe the final steps required to qualify as an Instructor.
Schedule your community discussion session.

Instructor checkout

1. Take part in an online **community discussion** session.
2. Take part in an online **teaching demonstration** session.
3. **Get Involved** with The Carpentries, and submit this to Amy, our database.

All trainees have **3 months (90 days)** from the end date of your training to complete checkout.

Exercise: Be The Expert, Checkout Q & A (10 min)

In small groups, read and discuss one of the three checkout procedures described on this page:

<https://carpentries.github.io/instructor-training/checkout>

Make notes in the Collaborative Document:

- What points do you think it is most important or helpful for people to remember?
- What questions or points of confusion do you have, or think others might have?

When you are done, report back to the full group about that stage of the process.

Exercise: Schedule a check-out step (5 min)

Take a moment to review your calendar and sign up for one or more sessions to get your checkout process rolling!

- Visit the Welcome Session
Etherpad: <https://pad.carpentries.org/welcome-sessions-2024>
- Visit the Teaching Demonstrations
Etherpad: <https://pad.carpentries.org/teaching-demos>
- If you would like to attend another community session for your 'Get Involved' step, visit the Community Sessions
Etherpad: <https://pad.carpentries.org/community-sessions-2024>

What does the badge mean?

1. **You can teach** Carpentries workshops.
2. **You get to vote** for Carpentries Executive Council
3. **You can register** for Carpentries **Bonus Modules**.
4. **You can share** it your CV

The Carpentries: How We Operate

Questions

- How is The Carpentries organised and run?
- What is the difference between SWC, DC, and LC workshops?
- How do you run a Carpentries workshop?

Objectives

- Get connected with The Carpentries community.
- Describe where you can go to get information on running a workshop.

A VERY BRIEF HISTORY OF



THE CARPENTRIES

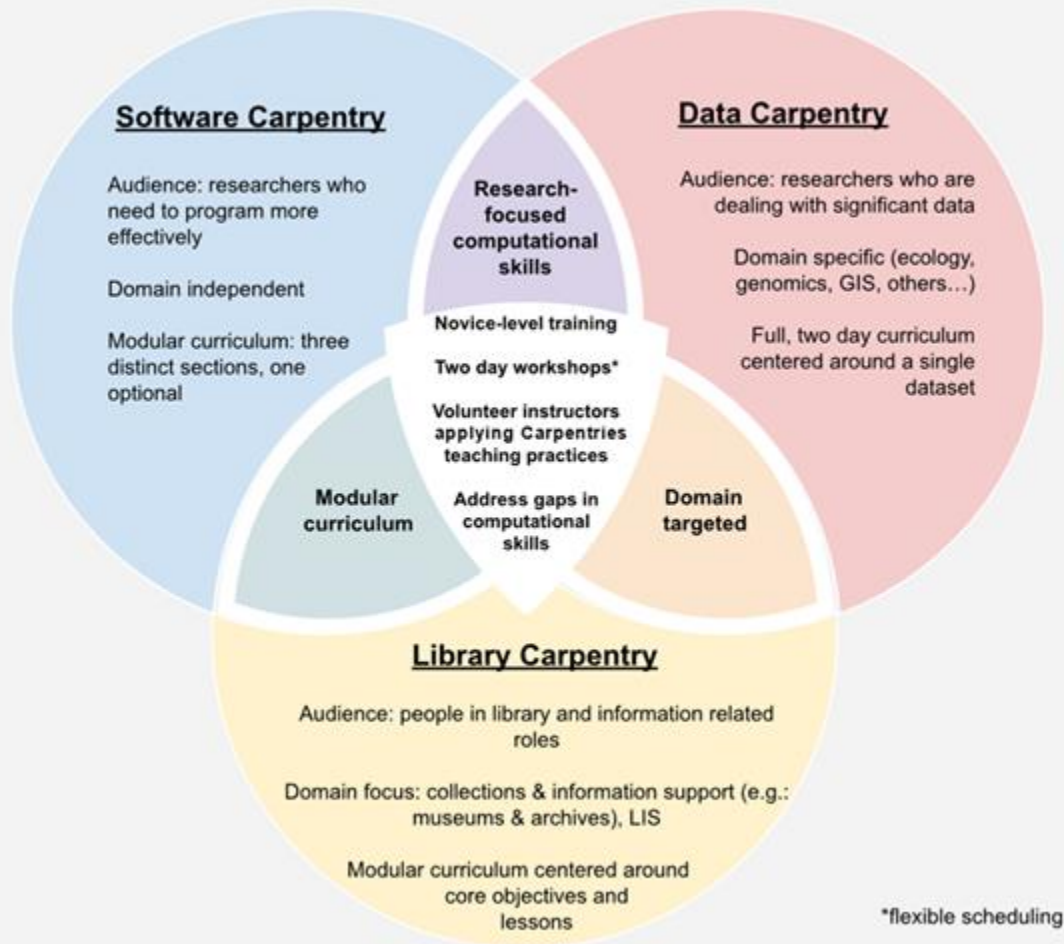


Software
Sustainability
Institute

GORDON AND BETTY
MOORE
FOUNDATION

NUMFOCUS

**COMMUNITY
INITIATIVES**
in service to great work



*flexible scheduling

Rules



Using the Names and Logos

- The names “Data Carpentry”, “Library Carpentry”, and “Software Carpentry” and their respective logos are all trademarked.
- You may only call a workshop a Data Carpentry, Library Carpentry, or Software Carpentry workshop if it meets the requirements.
- Please report ‘Mix and Match’ Workshop (there is a form for it)

Materials

All Carpentries lesson materials are freely available under a permissive open license.



Exercise: Carpentries Jargon (classroom)

How many of the following terms you can define?

- Lesson
- Episode
- Workshop
- Lesson Program
- Instructor
- (Instructor) Trainer

Organising a workshop

Two types of workshops:

Centrally organised

- From institutional membership
- Ad-hoc paid

Self-organised

- Consult The Carpentries Handbook
docs.carpentries.org

Setting Out On Your Own... Together: Lesson Incubation

- You can find two Workbench lesson templates available:
 - Markdown: this template is suitable for lessons that serve static content
 - RMarkdown: this template is suitable for lessons that include executable R code
- Any lesson that uses The Carpentries lesson templates follows our Code of Conduct, and is licensed either CC-BY or CC-0 can be hosted in The Carpentries Incubator.
- The Collaborative Lesson Development Training curriculum provides a guide to the backward design approach we recommend for lesson development.



Keep in touch

Want to listen?

- Sign up for our newsletter
- Follow us on Mastodon, Facebook, or LinkedIn

Want to interact (or listen with options to engage)?

- Join our Slack organisation
- Join our Email lists (start with “Discuss”!)

Want to join meetings (to meet new people or listen in)?

- Sign up for Community Discussions (or just drop in if there is space!) or other events when announced
- Explore taking on one of the Roles identified above

Exercise: Get connected (5 min)

Take a couple of minutes to **sign up for The Carpentries channels** you want to stay involved with on this page: <https://carpentries.org/connect/>

When you are done, share a channel you find interesting or useful on the Collaborative Document.

Topicbox:

[The Carpentries | Topicbox](#)

[local-netherlands | Topicbox](#)

Key Points

The Carpentries materials are all openly licensed, but names and logos are trademarked.

Carpentries workshops must cover core concepts, have at least one certified Instructor, and use our pre- and post-workshop surveys.

Guidance for teaching and hosting workshops is provided in The Carpentries Handbook.



Life coding is a skill

Questions

- Why do we teach programming using participatory live coding?

Objectives

- Explain the advantages and limitations of participatory live coding.
- Summarize the key dos and don'ts of participatory live coding.
- Demonstrate participatory live coding.

(Participatory) Live Coding

Instructors **do not use slides** to teach coding, but work through the lesson material, **typing in the code** or instructions, with the workshop **participants following along**.

Exercise Anticipate the Impact (5 min)

Think of advantages and challenges of participatory live coding from both a learner's and an instructor's point of view in the Collaborative Document.

Debugging and errors

Debugging as a skill – while learners may have negative associations with “mistakes” or “typos”, it may be useful to re-frame troubleshooting as the routine process of finding and fixing “bugs”.

Intentional vs accidental errors - It can be useful to intentionally demonstrate common mistakes and error messages. Alternatively, mistakes made by the Instructor or learners can offer useful opportunities to learn about and **positively frame errors**.

Exercise: Compare & Contrast

Watch two participatory live coding demo videos as a group. Write down feedback. Use the 2x2 rubric for feedback we discussed earlier.

In the videos, the bash shell for loop is taught, and it is assumed learners are familiar with how to use a variable, the head command and the content of the **basilisk.dat** and **unicorn.dat** files.

Top Ten Tips for Participatory Live Coding in a Workshop

1. Stand up and move around the room if possible.
2. Go slowly.
3. Mirror your learners' environment.
4. Use your screen wisely.
5. Use illustrations.

Top Ten Tips for Participatory Live Coding in a Workshop

6. Turn off notifications
7. Stick to the lesson material.
8. Leave no learner behind.
9. Embrace mistakes.
10. Have fun!

Exercise (25 min): Practice teaching

1. Split into groups of three.
2. Assign roles, which will rotate: presenter, timekeeper, note-taker.
3. Have each group member teach 3 minutes of your chosen lesson episode using live coding. For this exercise, your peers will not “code-along.” Before you begin, briefly describe what you will be teaching and what has been learned previously. Do not record this exercise.
4. After each person finishes, each group member should share feedback (starting with themselves) using the same 2x2 rubric as yesterday. The timekeeper should keep feedback discussion to about 1 minute per person; this may leave some time at the end for general discussion. The note-taker should record feedback in the Etherpad.
5. Trade off roles.

Key Points

- Live coding forces the instructor to slow down.
- Coding-along gives learners continuous practice and feedback.
- Mistakes made during participatory live coding are valuable learning opportunities.

Preparing to Teach



Preparing to Teach

Questions

- How should I prepare to teach?

Objectives

- Create a profile for a learner in your workshop.
- Critically analyze a learning objective for your workshop.
- Identify checkpoints in a lesson for formative assessment.

Exercise (5 min): Imagine a Learner

Take a moment to silently imagine a learner who might attend your workshop.

- What is their background?
- What problem do they face?
- What will they gain from attending your workshop?

Your learners

You will never know the full spectrum of neurodiversity represented in your workshop.

Thinking deeply about learners as people can help you prepare to bring your best self and provide an inclusive environment for everyone.

Remember Your Pre-Workshop Surveys

Examine Learning Objectives



Beware the Urge to Complicate

$$J = \pi \rho \int_0^R (R^2 - z^2) dz = A = \oint \vec{F} d\vec{l} = 0 \quad \left[\frac{n x F = ?}{1 + \frac{n x^2}{e^2} = m F^2} \right] \quad \frac{(n-1)}{1+(n+1)}$$

$$= \pi \rho \left[\int_0^R R^3 dz - 2 \int_0^R R^2 z^2 dz \right] + \int_0^L x^3 a \int \frac{dx}{\cos x} \quad \frac{1}{2} m A^2 \frac{\pi^2}{16} = 250 \text{ J } M = \rho V = \frac{5}{3}$$

$$M=0; \quad \pi \rho \left[R^5 - \frac{2}{3} R^5 + \frac{1}{5} R^5 \right] + \frac{1}{15} = \rho R^5 \quad \frac{1}{2} m A^2 \frac{\pi^2}{16} = 250 \text{ J } M = \rho V = \frac{5}{3}$$

$$\frac{x-3}{\sqrt{x^2+2x+3}} dx \quad \frac{1}{r^3} \int r' \cos \phi \rho d\omega \quad \frac{x}{(x^2+a)^2} = \int \frac{2(n+1)x^2}{(x^2+a)^{n+1}} (R^2 - z^2) dz$$

$$\frac{3M}{5\pi R} A_0 e^{-\gamma t} (\omega t + \alpha); \quad \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin$$

$$\frac{5\rho\pi R}{2VRT_1 \ln 2}; \quad \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin$$

$$p_z' = m' \frac{dz'}{dt'} = m' \frac{dz}{dt}; \quad \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin$$

$$\frac{d\sigma}{dT} F_2 = \frac{1}{h} \sum m \sigma_2^2 D \quad \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin$$

$$S = x_2 A_2 = RT \ln \frac{V_2}{V_1} F_m \quad \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin \frac{1}{2} m A^2 \omega^2 \sin$$

$$\frac{m A^2 \omega^2}{4\pi} \frac{g_1 \sigma_1 g_2 \sigma_2 r}{r^2 \sqrt{1 - \frac{v^2}{c^2}}} \frac{dv}{dt} \sqrt{1 - \frac{c^2}{c^2}} \sqrt{1 - \frac{c^2}{c^2}}$$

$$2 \frac{dv}{dt} = \frac{gE}{\mu} - \frac{gr}{2} \frac{dB}{dt} \quad \frac{9x+51}{x^2+2x+10} + \frac{1}{57} \arctg \frac{x+1}{3} + C$$

$$S = e^x \quad dv = \frac{gr}{2\mu} dS; \quad 2 \ln |x + \sqrt{4+x^2}| - 3 \sqrt{4+x^2}$$

$$S = e^x \quad \varphi = \rho ds \left(\frac{1}{r^2} - \frac{1}{r^2} \right) A'_{4-2} = \sigma RT, 1$$

Prepare to Use Formative Assessments

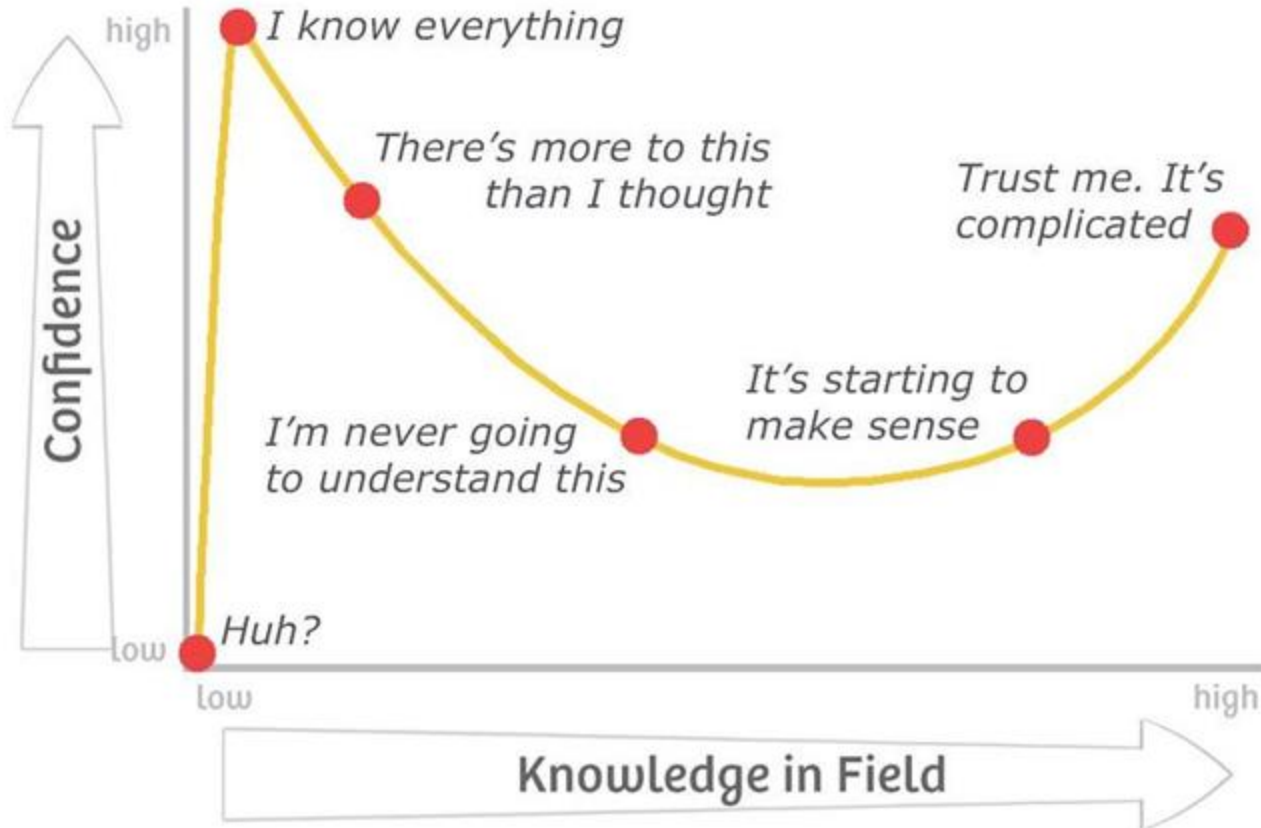


How frequent?

- Every 5 – 10 minutes.
- Depends on the “density” of the content.
- Used to break-up instructional time and refocus attention.

**“Do You Understand?” is Ineffective as a
Formative Assessment**

Dunning-Kruger effect



Prepare to Cut

- Keep breaks on time
- Watch out for dependencies
- Leave time to wrap up your workshop.
- Do not speed up.
- Communicate with your team.
- Communicate with your learners

Review the Instructor Notes

Handwritten notes on a spiral notebook page, featuring various mathematical problems, diagrams, and drawings.

Top Section:

- Drawings of a smiling sun, a star, and a small house.
- Mathematical problems:
 - $1\frac{2}{4} = \frac{6}{4}$
 - $1\frac{5}{6} = \frac{11}{6}$
 - $5\frac{1}{3} = \frac{16}{3}$
 - $4\frac{2}{7} = \frac{30}{7}$
 - $3\frac{5}{8} = \frac{29}{8}$
 - $2\frac{1}{2} = \frac{5}{2}$
 - $3\frac{3}{4} = \frac{15}{4}$

Middle Section:

- Mathematical problems:
 - $\frac{8}{7} = 1\frac{1}{7}$
 - $\frac{7}{3} = 2\frac{1}{3}$
 - $\frac{11}{8} = 1\frac{3}{8}$
 - $\frac{7}{2} = 3\frac{1}{2}$
 - $\frac{10}{4} = 2\frac{2}{4}$
 - $\frac{18}{4} = 4\frac{2}{4}$
 - $\frac{14}{6} = 2\frac{2}{6}$
- Diagrams: A grid with a star, a grid with a cross, and a grid with a circle.

Bottom Section:

- Mathematical problems:
 - $\frac{2}{4} = \frac{6}{4}$
 - $\frac{5}{6} = \frac{11}{6}$
 - $\frac{1}{3} = \frac{16}{3}$
 - $\frac{2}{7} = \frac{30}{7}$
 - $\frac{5}{8} = \frac{29}{8}$
 - $\frac{1}{2} = \frac{5}{2}$
 - $\frac{3}{4} = \frac{15}{4}$
- Diagrams: A grid with a star, a grid with a cross, and a grid with a circle.

Bottom Right Section:

- Mathematical problems:
 - $\frac{1}{2} = \frac{2}{4} = \frac{5}{10} = \frac{3}{6} = \frac{4}{8} = \frac{8}{16} = \frac{7}{14}$
 - $\frac{1}{3} = \frac{4}{12} = \frac{3}{9} = \frac{2}{6} = \frac{3}{9} = \frac{5}{15} = \frac{7}{21}$
 - $\frac{1}{5} = \frac{5}{25} = \frac{10}{50} = \frac{13}{65} = \frac{22}{110} = \frac{5}{25} = \frac{100}{100}$
 - $\frac{0}{2} = \frac{0}{5} = \frac{0}{7} = \frac{0}{9} = \frac{0}{13} = \frac{0}{50}$

[illegible]

Connect
With
Your
Team



Key Points

- To teach effectively, you have to know who you are teaching.
- Good learning objectives identify specific events that can be evaluated through formative assessment.
- A good exercise informs Learners and Instructors when an objective is achieved.



Photo by [Jon Tyson](#) on
[Unsplash](#)



Instructor Training Day 4

Welcome Back

Day 4

More practice live coding

Working with your team

Launches and Landings (how to start the workshop)

Putting it all together

Wrap-up

More Practice Life Coding



Question:

How did you change your teaching in response to feedback?

Objective:

Use feedback to improve your teaching.

Live demo rubric (10 min)

Read the rubric that is given to Instructor Trainers as a suggested framework for evaluating the online teaching demonstration sessions that are part of Instructor checkout.

https://data-lessons.github.io/instructor-training/demos_rubric/.

What questions do you have?



More practice live coding (25 min + 10 min discussion)

Return to your groups and repeat the previous live coding exercise, re-teaching the same content as before (3 minutes!). This time, the presenter should incorporate changes based on feedback received, and everyone should try to 'level up' their feedback using the rubric for teaching demos (5 minutes).

When you are finished, share some thoughts on this process in the plenary discussion: What did you change? Did it work better or worse with the change? How might you do it if you were to teach it again?



Key Points:

**(Reflective) Practice
makes perfect.**

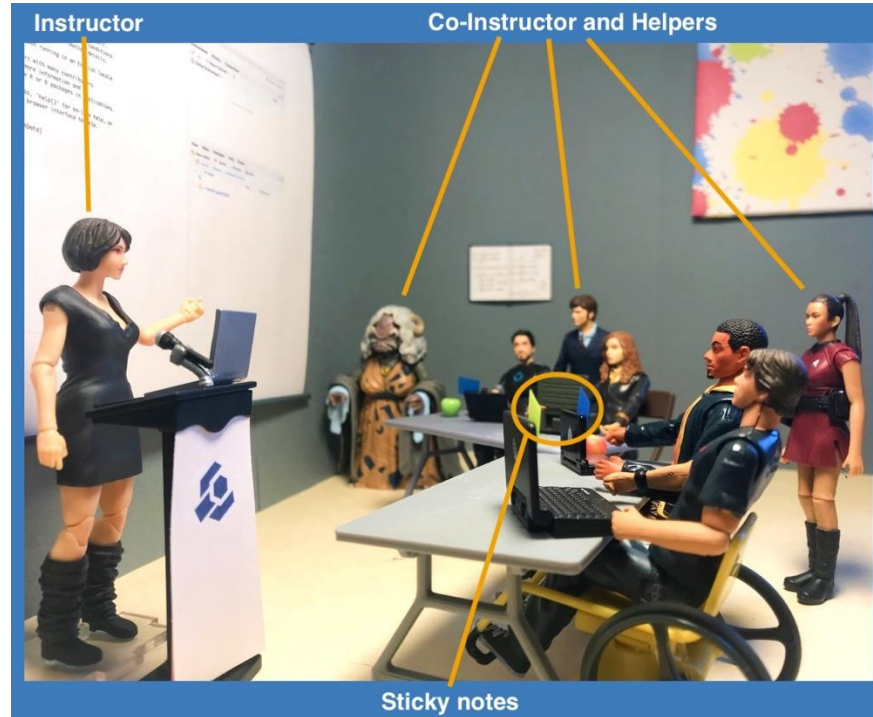


Working With Your Team



- What are the challenges of managing a heterogeneous classroom?
What should we do if there is a Code of Conduct violation?
What does it mean to be a co-Instructor?
How does an instructional team prepare for a workshop?

Never teach alone



Roles

- Host
 - Logistics (unrelated to teaching)
 - Checklist in [Carpentries Handbook](#)
- Co-instructors who are either:
 - Team teaching
 - Teach and assist
- Helpers
 - Setup and installation
 - Monitoring the room to spot people who need help during class or exercises
 - Monitoring the shared notes and answering questions there / reminding the Instructor
 - [Helper checklist](#)

Carpentries Classroom Practices

- Starting with Code of Conduct
- Participatory Instruction & Hands-off Help
- Sticky Notes
- Formative Assessment
- Breaks with snacks
- Feedback

Sticky Situations



fig rolls stuck together by [fsse8info](https://www.fsse8info.com)

1. Learners at many levels

- Communicate level clearly, describe topics
- Beginner and advanced options for exercises
- Encourage learners to help others
- Do not let advanced learners take over the conversation
- Be vigilant for learners who are falling behind

2. Code of conduct violations

- Ensures that our community does not tolerate or encourage the persistence of harmful behaviors
- Incidents must be reported for the CoC to work well
- When in doubt, report (not the responsibility of the reporter to determine if there has been a CoC violation or not)
- Discuss how to manage CoC violations in advance

Know your resources (10 minutes)

Take 5 minutes to read through the Code of Conduct Incident Response Guidelines:

https://docs.carpentries.org/topic_folders/policies/incident-response.html

Discuss what you have read in small groups. As questions arise, you may wish to refer to our complete Code of Conduct section in The Carpentries Handbook or to the Transparency Reports released by The Carpentries Code of Conduct Committee (links in CodiMD)

What kinds of things could your instructional team agree upon in advance of your workshop?

What questions do you have about CoC enforcement? Write in the CodiMD



2. Code of conduct violations

- Fortunately, violations have been extremely rare

Planning together

- Planning is half the fun!
- Connect with people on your instructional team
- Share the load of planning a workshop



Teaching together – Nuts and Bolts (10 minutes)

With a partner, imagine that you are planning a workshop together. For this exercise, you may assume that your workshop has a separate, designated Host.

- How would you prepare to teach a workshop together?
- How would you coordinate with other members of your instructional team (e.g. Host, Helpers)?
- What kinds of things will you do to support each other during the workshop? What won't you do?
- Record some notes, and share your thoughts with the group.



Co-instruction suggestions

- Decide who teaches what and for how long
- Advance preparation together or asynchronously
- Practice together
- What information is needed to advertise and communicate: Audience, in person vs online, setup instructions and setup sessions
- Where will you communicate together?
- Who is the contact person for participants?
- Discuss how to manage CoC violations in advance
- Signal things like going too fast / who needs help / it's time for a break - agree on the signal if people do not like to be interrupted
- Active classroom assistance Carpentries style
- Who sets up the repository and HackMD / CodiMD?

Key points

- Working with a broad range of learners can be challenging, but there are many ways to keep a classroom happy and motivated
- The instructional team decides how to respond to Code-of-Conduct incidents during a workshop; all violations should be reported to The Carpentries Code of Conduct committee for follow-up.
- Team work takes work, but allows you to share the load and build connections

Launches and landings

- How do you actually start a workshop?

The introduction

- How do good workshops begin?
- Introductions set the tone for the workshop and the path for learning
- Empowering, yet intimidating moment
- Having a plan relieves stress and will get you started

What is an introduction?

Discuss in pairs:

What do you hope to accomplish in a workshop introduction?

What information do you need to include in an introduction to accomplish these goals?



After the introduction, learners should

- be able to predict the type of instruction
- know what will be taught
- understand what will be required of them
- believe that they can learn from the workshop

After the introduction, the instructional team should

- know who is participating in the workshop and what their expectations are
- have an initial impression of how learners respond to participation prompts and what will be needed to encourage them to engage

Setting the stage

- Attire
- Physical environment
- Your use of the few minutes before class
- Introduction of yourself
- Your doubts
- The classroom community and icebreakers

Teaching your trajectory: what you can communicate

- Describe the prerequisites
- Schedule and logistics
- Workshop structure
- Your expectations (Code of Conduct, asking for help / feedback)
- Baseline data on learners
- Advice for success
- Whet appetite for workshop content

The art of a smooth landing



Brainstorm: making the last moments count (5 minutes)

What could you do at the end of a workshop? What would be the value?



Brainstorm: making the last moments count (5 minutes)

What could you do at the end of a workshop? What would be the value?

- Close and save files
- Reflect on learning
- Plan next steps
- Reiterate where lesson materials are
- Collect feedback
- Check with the host to see if they have closing remarks or instructions
- Celebrate hard work



Key points

- A planned introduction is key to creating a functional workshop environment
- Conclusions support reflective practice and set the stage for continued learning

Putting it together (5 minutes)

Based on the content we've discussed throughout this workshop, add at least one item to each category below in the CodiMD:

- Concepts/Theories
- Tools/Practices

This exercise can be done individually and should take about 5 minutes.



Key Points

- Model of **learner-centered** teaching - this type of teaching is not really about the teacher (and what they want to talk about), but the learners and how things we teach can be useful to them
- The more we know about learner's **backgrounds, motivations**, and **how they learn** and what interventions can address these issues, the more effective our teaching can be.
- You **do not need to be an expert** in the content you are teaching – ANYONE can learn, practice and improve their teaching, as with any skill.
- Having a plan makes it easier for you to remember to implement the important teaching practices you have learned.

Wrap Up & Time for Feedback



Good luck on your teaching journey!

