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Visual Literacy Workshop
Attendee Guide

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Team & Attendees

Groups	Attendees		Moderators
Group 1: **Molecular Biology** **& Biochemistry**	Kristen Procko Rou-Jia Sung Rachel Mitton-Fry	Daniel Gurnon Eric Neff	Gaël McGill Stuart Jantzen
Group 2: **Cell Biology**	Mona Monfared Claire Dell Eli Carlisle	Jennifer Landin Jason Patterson	Jodie Jenkinson Amy Zhang
Group 3: **Ecology &** **Evolutionary Biology**	Sanja Hinić-Frlog Justin St. Juliana Amy Keagy	Brian Gillespie Alexis Ackerman	Susan Keen Samantha Li

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What to expect from this workshop

In this co-creation workshop, we will develop active learning materials for teaching biology topics prone to misconceptions by visual representation.

Goals for this workshop:

- Gain a better understanding of instructors' experience with teaching topics prone to misconceptions by visual representation
- Identify strategies for remediating misconceptions through selection and design of visual media
- Develop active learning material for different approaches to learning visual science literacy at different scales of biology
- Co-author a meeting summary and explore dissemination of learning materials

This is an interactive workshop, so we will be asking you to participate.

- Part of our goal is to show how design is often a collaborative pursuit, and that co-creation and feedback can result in better solutions.
- Participating in creative collaboration will result in a more memorable and effective learning experience.

Ground rules:

- Roll up your sleeves
- Stay focused and be present
- Build on the ideas of others. Use *"Yes, **and**"* instead of *"Yes, but".*
- Chatham House Rules: Attendees are free to use information from discussions, but are not to reveal who made any particular comment.

Agenda

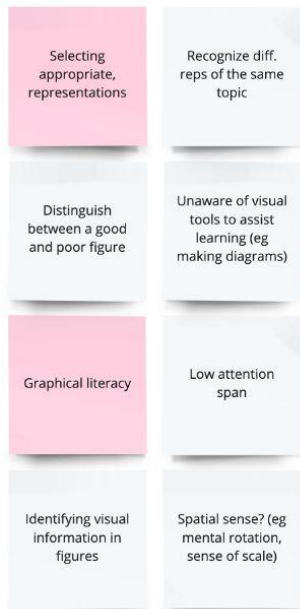| Time	Activity
09:20	**Workshop Introduction**
09:30	**Analyze** Persona Building Five Whys
10:10	**Define** Before-After-Bridge
10:30	**Group Discussion**
10:55	*Bio Break*
11:00	**Design** Activity Design
11:50	**Group Discussion**
12:20	**Wrap-Up**
12:30	*End*

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Visual Literacy Challenges

In a pre-workshop survey we asked attendees to identify challenges associated with visual literacy
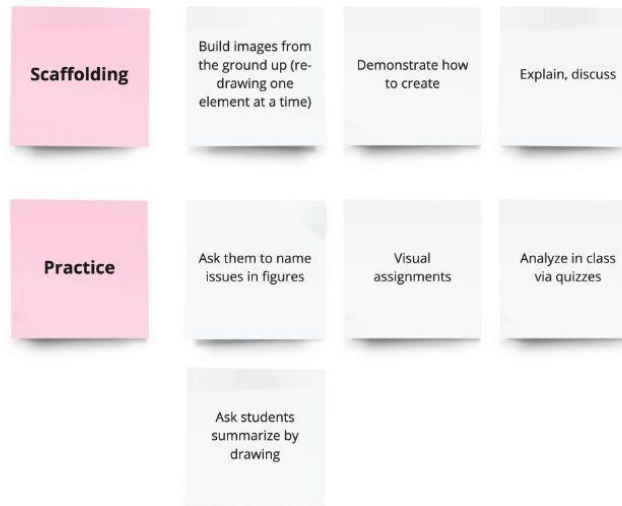
Selecting appropriate representations and graphical literacy featured prominently. With respect to addressing these challenges, participants identified scaffolding and practice as effective strategies

A successful primer was described as one that scaffolds understanding, contains practical activities and guidance on interpreting visuals. As well it would include best practices, integrate readily into teaching practice, and address commonly taught subjects.

Common challenges faced by students

Selecting appropriate, representations	Recognize diff. reps of the same topic
Distinguish between a good and poor figure	Unaware of visual tools to assist learning (eg making diagrams)
Graphical literacy	Low attention span
Identifying visual information in figures	Spatial sense? (eg mental rotation, sense of scale)

Current strategies used by instructors

Scaffolding	Build images from the ground up (re-drawing one element at a time)	Demonstrate how to create	Explain, discuss
Practice	Ask them to name issues in figures	Visual assignments	Analyze in class via quizzes
	Ask students summarize by drawing		

What a successful primer looks like

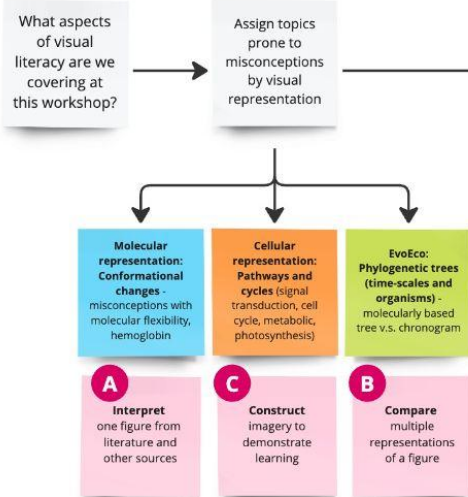|				
For students	Scaffolding	Practical activities	Individualized	Contains guides for interpreting visuals
For instructors	Best practices for incorporating visualizations	Evaluated and proven effective	Integrates easily into current practice	Activities and assessments, with guidance/ rubrics
	Addresses commonly taught topics	Well-organized		

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Design Framework

We will use an instructional design framework (adapted from the ADDIE Model [1] and Design Thinking Process [2]) to design our active learning materials. The workshop outline below shows the steps we will take to analyze the problem, define the ideal learning experience, and design the solution.
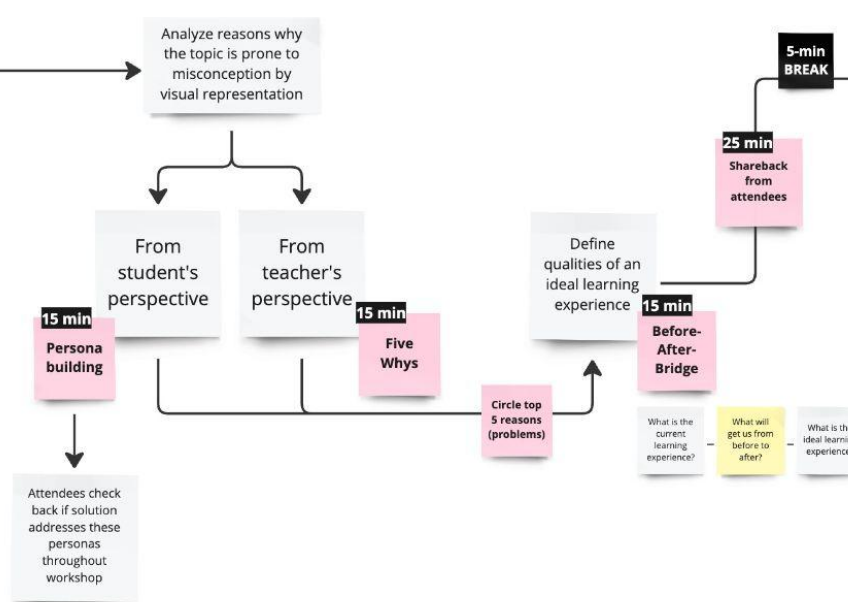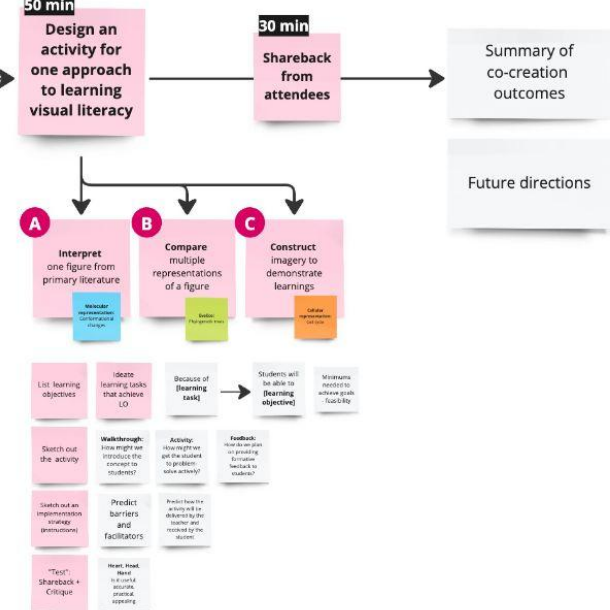
1. Branch, R. M. (2009). Instruction Design: The ADDIE Approach.
2. Stanford d. School (2010). An Introduction to Design Thinking Process Guide.

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Activities

Persona Building

Analyze and understand the problem from a learner's perspective.

Who is using (or will use) your resource and why? Building a persona helps you start thinking about who you are designing for, and why. It gets your assumptions about the learner and their perspective on paper. As you build a solution to the problem, you can check it against this persona to make sure it addresses issues in the current learning experience.

Instructions:

Fill in the following sections of the template:

1. **Sketch & name:**
   Give life to your persona with a name, a role, and a doodle of the learner.

2. **Characteristics:**
   Write demographic information and traits about your learner's behaviour.

   E.g., they are an incoming first-year science student, therefore they may have no background knowledge in the topic.

3. **Strengths and Challenges:**
   Capture the strengths and constraints of the novice learner regarding your topic. Try to be specific so you can better tailor your learning solution later on.

Five Whys

Get to the root cause of a problem from an instructor's perspective.

When faced with a problem, channel your inner inquisitive child and ask "why?" repeatedly to get to the root cause. By identifying the root cause, we can build our solution around the heart of the issue rather than tackling more superficial aspects.

Instructions:

1. The moderators will lead the discussion by asking the first question:

   "Why is [my scientific topic] prone to misconception by visual representation?"

2. Write down **one** major cause/reason for this issue

3. Ask "why?" again four times and include the previous answer in the question to keep a narrow focus on the problem:

   "Why is [this cause for this issue] occurring?"

4. Expand on additional factors (if any) for each of the questions and their causes.

☺ Persona Building

Who is using (or will use) your resource and why?

Building a persona helps you start thinking about who you are designing for, and why. It gets your assumptions about the learner and their perspective on paper.

Sketch & Name
Give life to your learner with a name, a role, and a rough sketch of their face.

Characteristics
Write demographic information and traits about your learner's behaviour.

Strengths
What are strengths of the novice learner regarding your specific topic?

Challenges
What are constraints of the novice learner regarding your specific topic?

Topic:

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⊘ Five Whys

Why is `topic`
prone to misconception by visual representation?

When faced with a problem, channel your inner inquisitive child and ask **"why?"** repeatedly to get to the root cause.

Include the previous answer in the question to keep a narrow focus on the problem.

Example:

"Why did the robot stop?"
• The circuit overloaded, causing a fuse to blow.

"Why is the circuit overloaded?"
• There was insufficient lubrication on the bearings, so they locked up.

"Why is there insufficient lubrication on the bearings?"
• The oil pump on the robot is not circulating sufficient oil.

"What is the pump not circulating sufficient oil?"
• The pump intake is clogged with metal shavings.

"Why is the intake clogged with metal shavings?"
• Because there is no filter on the pump.

Source: Toyota / Workshop Tactics

Why is `topic`
prone to misconception by visual representation?

Because...

Expand on additional factors or causes behind this "why" and "because"

Why...

Because...

Why...

Because...

Why...

Because...

Why...

Because...

Topic: _____

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Before-After-Bridge

Describe a current problem, imagine the ideal scenario, and bridge the gap with a solution.

In Before-After-Bridge, we describe problems in the current learning experience, imagine our world with these problems solved, and define actionable solutions or "bridges" that can get us to an ideal learning experience. This activity shifts us from an analytical mindset to a problem-solving one.

Instructions:

1. In the **Before** column, write down five problems that you identified in Persona Building and Five Whys. Prioritize problems that make the most meaningful impact when solved and are feasible to solve.

2. In the **After** column, written down the ideal learning experience that corresponds with each of the five problem.

3. In the **Bridge** column, write down an solution or "bridge" for each problem (Before) and ideal scenario (After).

   At this stage, we want to be open to all possible solutions. Once we've written down the ideal solution, we can consider its practicality (e.g., how it will be delivered; resources required). List alternative solutions if the ideal one is not as actionable.

Attendees will present their work for feedback after this activity.

Prioritization Matrix
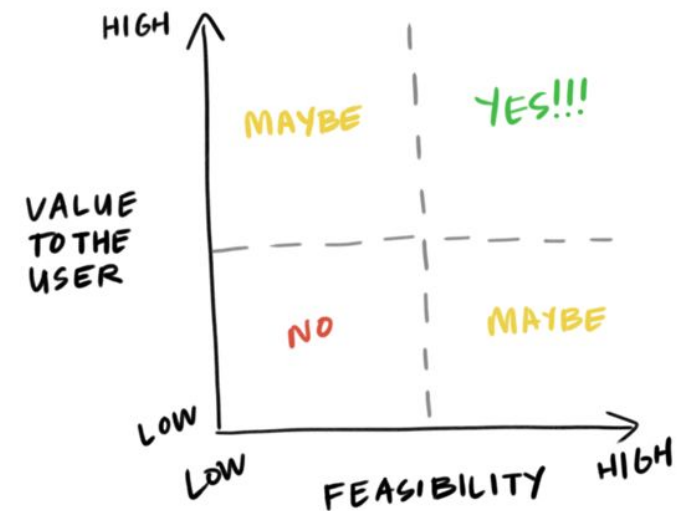
Source: Using Prioritization Matrices to Inform UX Decisions by Nielsen-Norman Group.

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⚠ Before

What is the current learning experience?
What problems are we facing?

⛩ Bridge

What can get us from before to after?

⚑ After

What is the ideal learning experience?
Imagine our world with this problem solved.

Topic:

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Activity Design

Design a learning activity that uses one approach to visual science literacy.

We will design and structure an activity that helps students learn your topic by either (A) **constructing** imagery to demonstrate learning, (B) **comparing** multiple representations, or (C) **interpreting** visual representations from literature and other sources.

Our design decisions will be informed by the current issues, ideal learning experience, and potential solutions we've previously analyzed and defined. At every step, we can "check-in" with our learner persona to make sure our activity is addressing their needs.
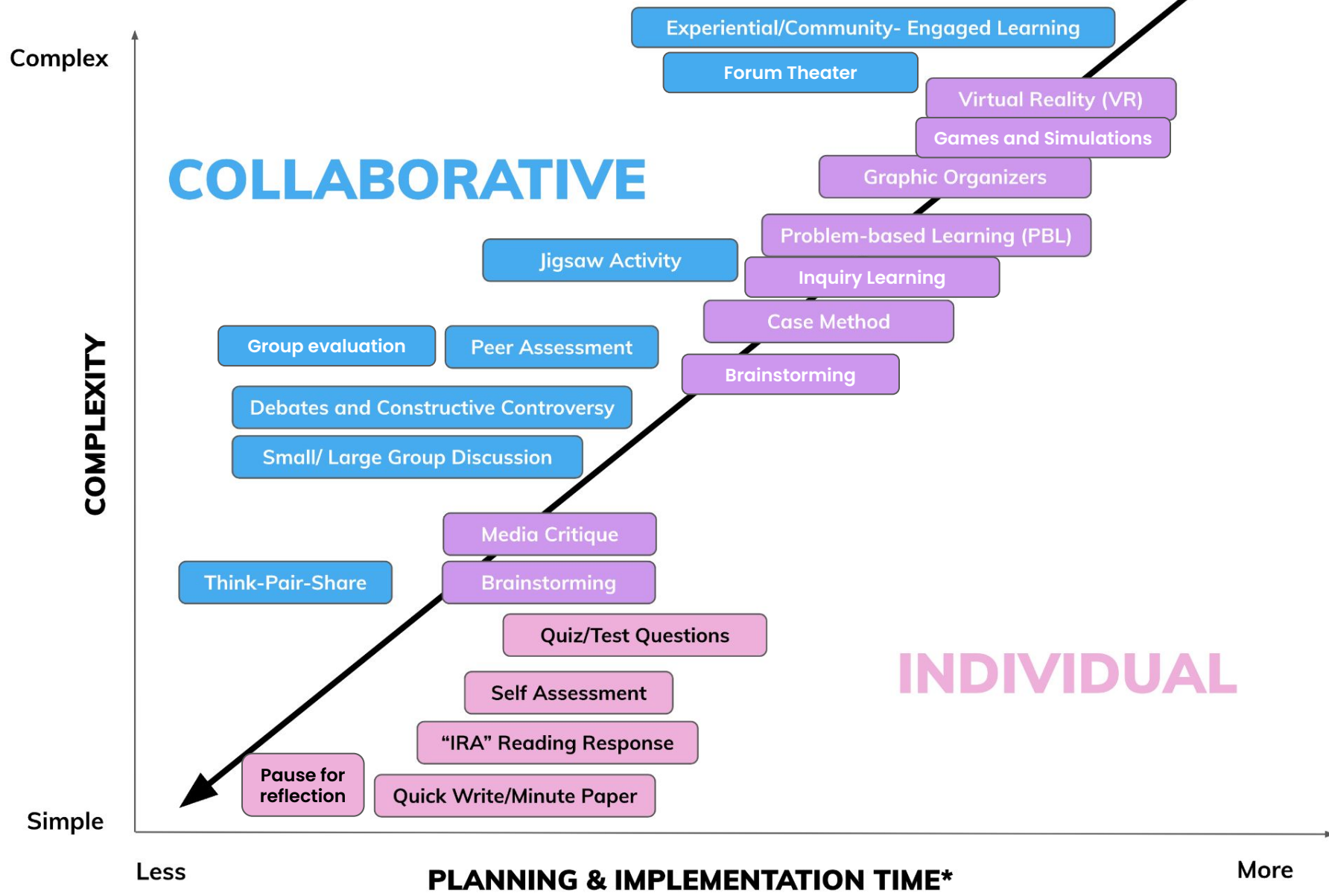
Instructions:

1. List five **learning objectives** for your specific topic. You can tailor the education/course level, curriculum, etc. according to your learner persona.

2. Decide on **learning tasks** - features of your activity - that can help the learner achieve each of the learning objectives. Consider the feasibility of these tasks, how they will be delivered, the time and resources they'll require. *(See examples of active learning strategies on the next page).*

3. Create the **sequence** in which learners will perform these tasks. Once you've mapped the overall structure of the activity, flesh out the details of each task (e.g., length of activity, materials needed, scaffolding required, etc.).

4. Predict how your activity might be replicated and delivered by another instructor, and received by their students. Jot down potential **barriers and facilitators** to implementing this learning experience.

*Attendees will present their work for feedback after this activity.

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Active Learning Strategies - A Continuum for Exploration

These are illustrative examples, not a comprehensive list

Complex

COLLABORATIVE

- Experiential/Community- Engaged Learning
- Forum Theater
- Virtual Reality (VR)
- Games and Simulations
- Graphic Organizers
- Problem-based Learning (PBL)
- Jigsaw Activity
- Inquiry Learning
- Case Method
- Group evaluation
- Peer Assessment
- Brainstorming
- Debates and Constructive Controversy
- Small/ Large Group Discussion
- Media Critique
- Think-Pair-Share
- Brainstorming
- Quiz/Test Questions

INDIVIDUAL

- Self Assessment
- "IRA" Reading Response
- Pause for reflection
- Quick Write/Minute Paper

COMPLEXITY

Simple

Less

PLANNING & IMPLEMENTATION TIME*

More

*The larger your class, the longer the planning and implementation time

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ⓐ Activity Design

Topic

Approach *Circle one*

| **Construct** imagery to demonstrate learnings | **Compare** multiple representations of a figure | **Interpret** one figure from primary literature |

Learning Objectives

What do learners need to know about this specific topic?

Learning Tasks / Activity Features

What tasks can the learner do to help them achieve the learning objective? Consider the feasibility of these tasks and how the tasks will be delivered (format).

Topic: _____

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1 *Map out the order in which learning tasks / activity features will be performed.*

2 *What are potential barriers and facilitators to implementing this learning experience? Predict how the activity will be delivered by an instructor and received by your student persona.*

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