



Cold Spring Harbor Laboratory

Riding the Bicycle

— *Effective, inclusive, and scalable training in the life sciences, clinical education and beyond*

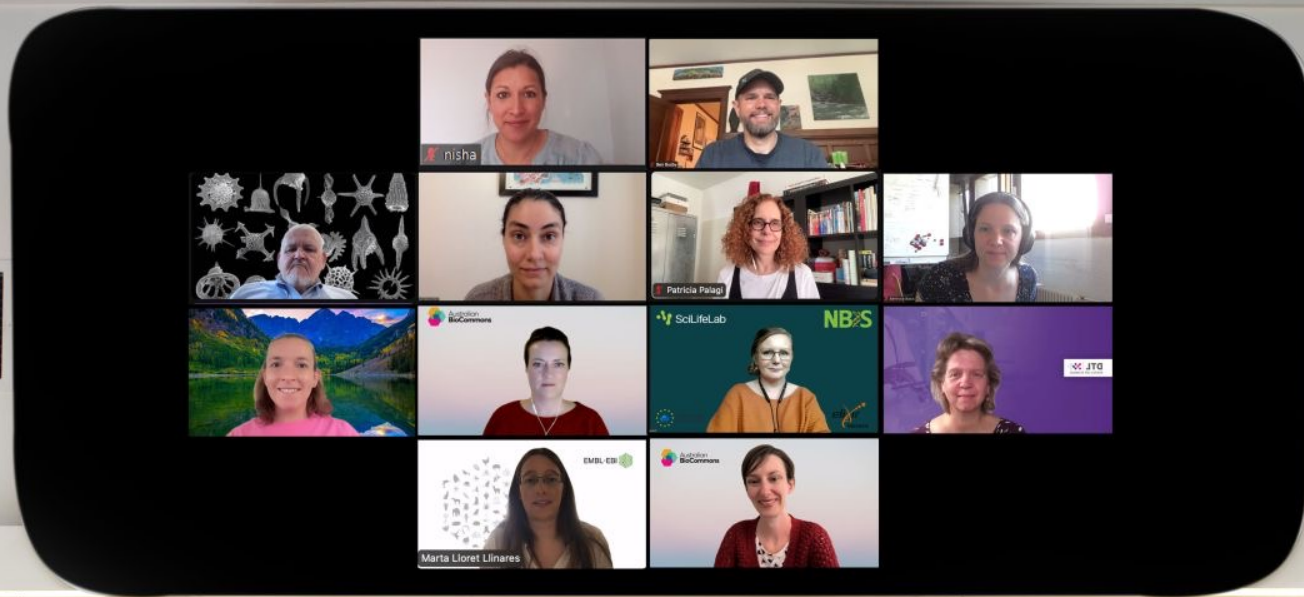
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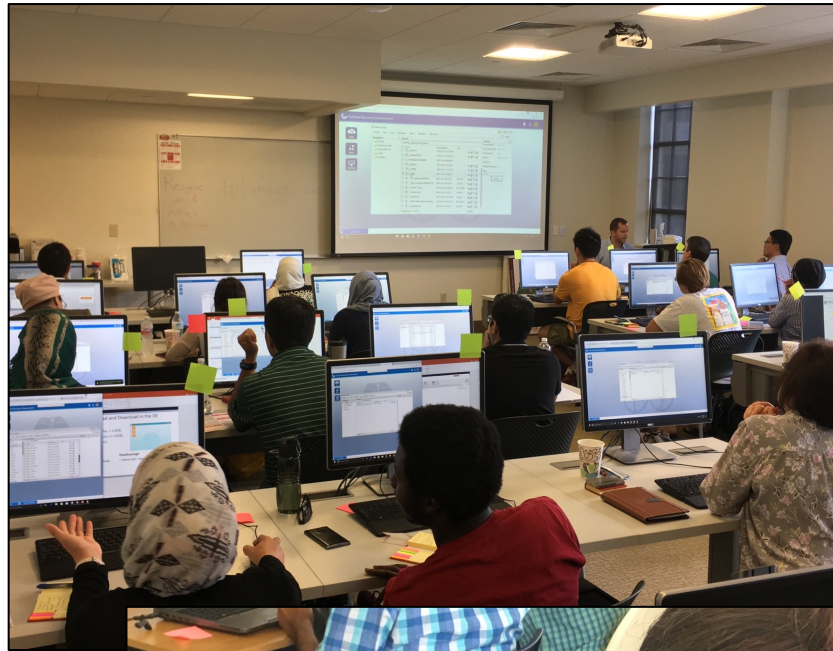
Are we wasting our time with training?

**Null effects of boot camps and
short-format training for PhD
students in life sciences - Feldon
et.al., PNAS 2017**

“Here we show that participation in such short-format interventions is not associated with observable benefits related to skill development, scholarly productivity, or socialization into the academic community.”



cyverse.org



STEM Careers and the Changing Skill Requirements of Work - Deming & Noray, NBER 2019

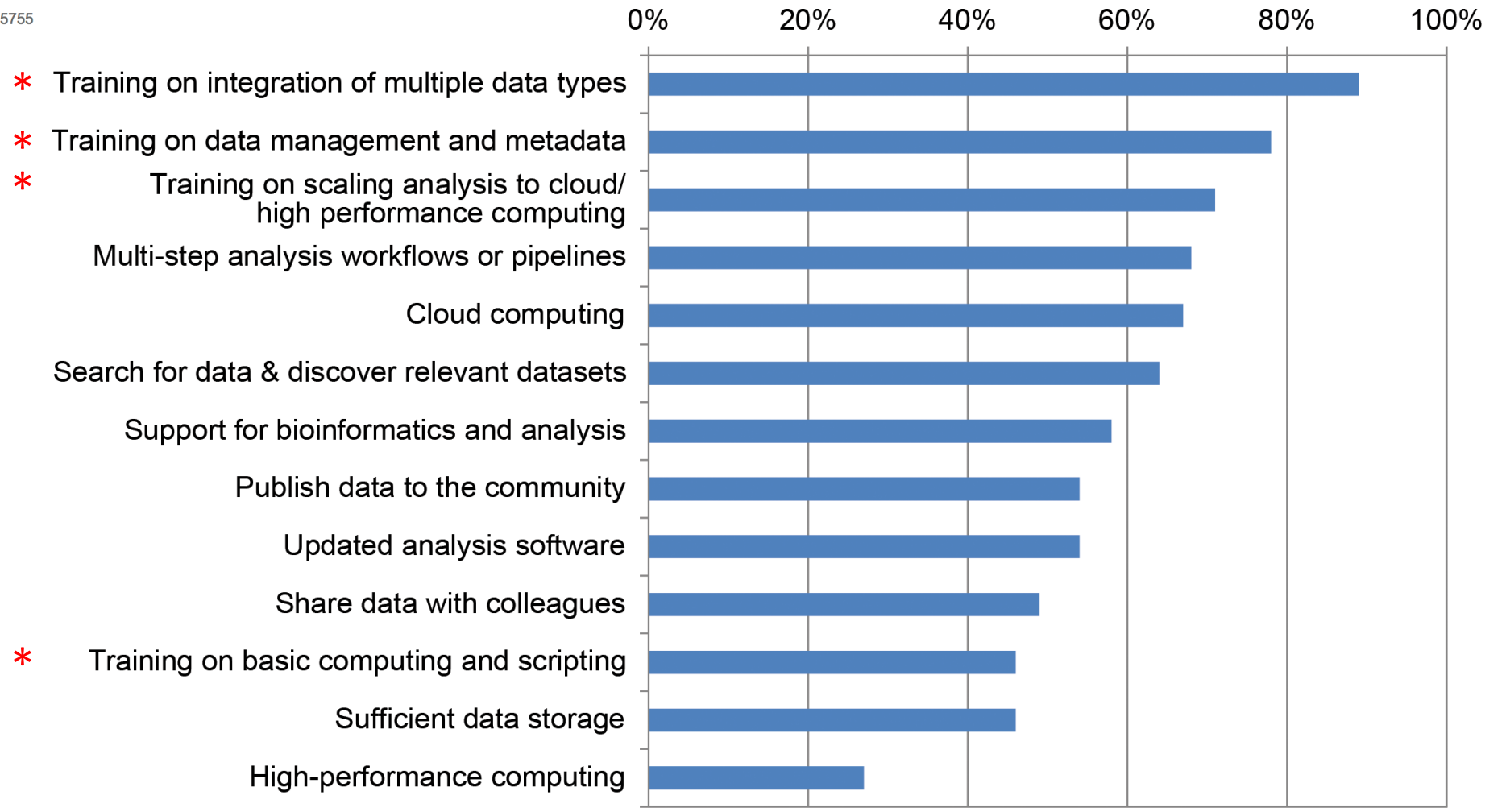
“[O]ver time, new technologies replace the skills and tasks originally learned by older graduates, causing them to experience flatter wage growth and eventually exit the STEM workforce. Faster technological progress creates a greater sense of shortage, but it is the new STEM skills that are scarce, not the workers themselves.”

Unmet needs for analyzing biological big data: A survey of 704 NSF principal investigators

Lindsay Barone , Jason Williams , David Micklos 

Published: October 19, 2017 • <https://doi.org/10.1371/journal.pcbi.1005755>

“Does your institution meet this need?”
('no' responses)



Teaching is not SFT

Long format (formal) teaching



Teaching is not SFT

Long format (formal) teaching

- **Time:** Long – quarters/semesters
- **Format:** Lecture heavy; some hands-on
- **Pre-req:** Articulated and enforceable
- **Learner prep:** Prespecified prep/needs
- **Instructor:** Expectation of qualification
- **Regulation:** Standards or laws apply
- **Sequence:** Within a major/minor
- **Variance:** Highly predictable/repeatable

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Short format (informal) training

- **Time:** Short – hours/days/few weeks
- **Format:** Focus on interactive/hands-on
- **Pre-req:** Unarticulated and unenforceable
- **Learner prep:** heterogenous prep/needs
- **Instructor:** Domain not pedagogy expert
- **Regulation:** Unlikely to be regulated
- **Sequence:** sequenced/learner-driven
- **Variance:** Often unpredictable/unrepeatable

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Formal
evidence
about
teaching
applies

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Achieving our vision requires more than communicating ideas.

We must build communities and support them...



Building community...



LIFESCITRAINERS.ORG

ACCELERATING SCIENTISTS

Why short-format training?

In many areas of the life sciences new technologies and approaches (especially, but not only computational ones) are changing rapidly. It's not possible for formal training (undergraduate/graduate) to keep pace, but short-format training can fill these gaps. Short-format training comes with its own set of challenges, and this community works together to address them.

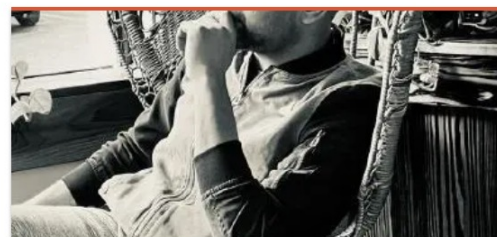


How I Teach Life Scientists...by Using Reproducible and Scalable Learning Environments

May 12, 2022 /// No Comments

The combination of Docker + cloud computing service enables a teacher to create a highly scalable and flexible learning environment

[Continue reading »](#)



How I Teach Life Scientists...to Build Reproducible, Scalable Workflows with Nextflow

April 20, 2022 /// No Comments

The term "reproducible research" has been used to describe the idea that a scientific publication should be distributed along with all the raw data and metadata used in the study, all the code and/or computational notebooks needed to produce results...

[Continue reading »](#)



March 2022: Community Discussion – The Return to In-Person Training

March 14, 2022 /// No Comments

Many instructors have or shortly will be running their first in-person events since the pandemic, what will change?

[Continue reading »](#)

Wednesday, June 29th ▾



Melissa Burke 9:46 PM

Hi all, what is your average completion rate of feedback surveys for workshops? For our completely online workshops we're getting ~37%. I'm wondering how this compares and if we can improve. Any tips?

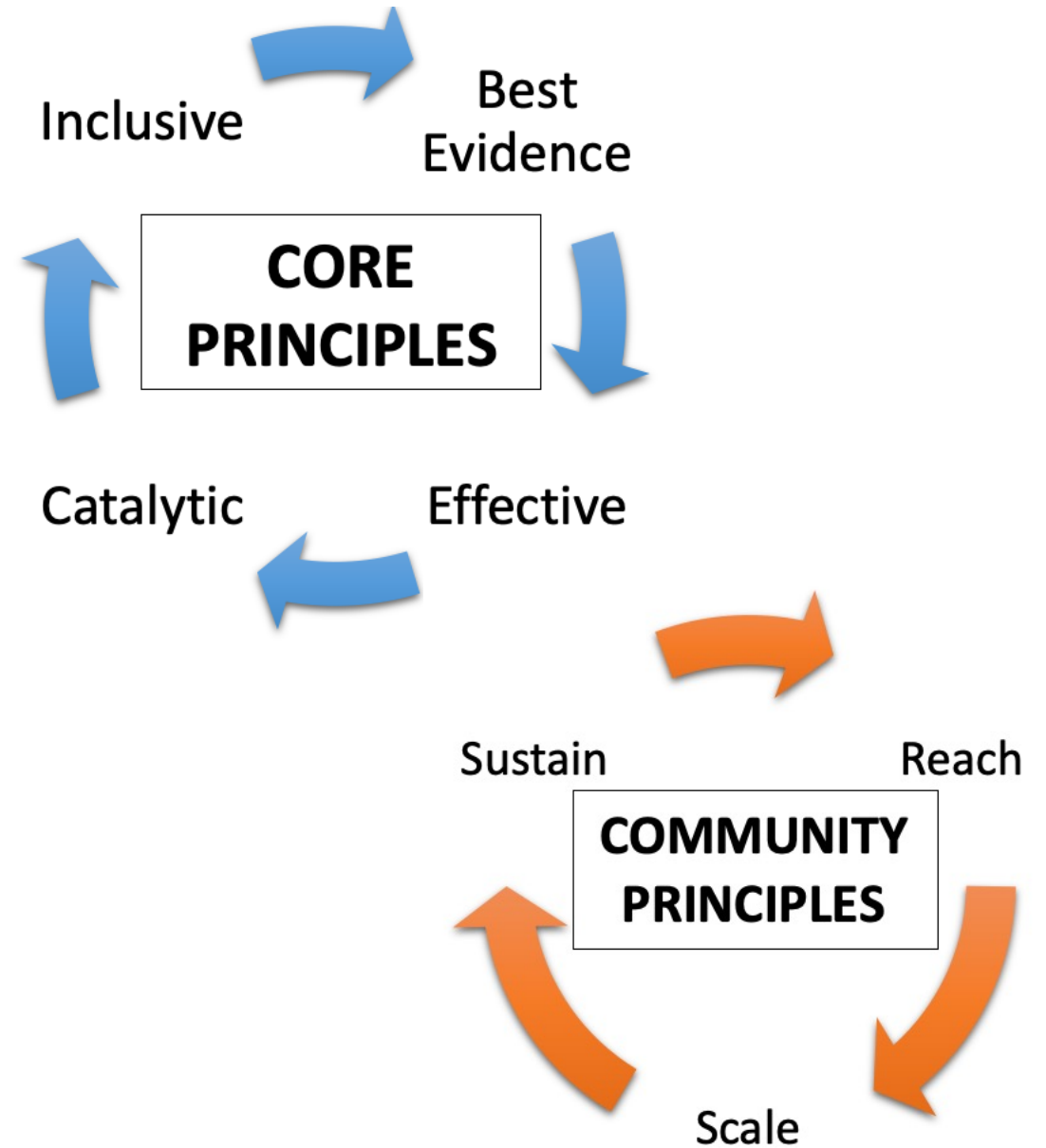
From past experience I know this tends to be higher for in person workshops, especially when time is allowed in the schedule for completing the survey.



12 replies Last reply 6 days ago

Supporting community...

The Bicycle Principles for Effective, Inclusive, and Career-spanning Short-format Training



Developing a community-driven
strategy...



ANNOUNCEMENT

Making Career-spanning Learning in the Life Sciences Inclusive and Effective for All

Late 2021

Organized by: Jason Williams, Cold Spring Harbor Laboratory
Rochelle Tractenberg, Georgetown University
Bérénice Batut, University of Freiburg
Samuel Donovan, University of Pittsburgh
Kari L. Jordan, The Carpentries
Charla Lambert, Cold Spring Harbor Laboratory
Teresa Mourad, Ecological Society of America
Tracy Teal, Dryad
Celia van Gelder, Dutch Techcentre for Life Sciences

Refine or reconsider

- Given that effective/catalytic solutions should be the ones modified for inclusivity (and shareability/scalability), are there aspects of the solution to study or change (or both)?

Solution-to-model

- For the solution, consider whether the efficacy and/or catalysis, or other features, might make it more, or less inclusive, scalable, shareable, where is the solution likely to lead to other challenges?

Choose a challenge

- Identify 1-3 challenges; choose facilitator for each.
- reword, refine, and define/operationalize each as necessary

5-phase model

- Learning Outcomes-> Learning Experiences->Content ->Assessment ->Evaluation
- Do any/each of these phases help structure a response to the challenge=strategy?

Refine strategies

- Recommended reading offers structure for solution (evidence-based).
- describe a context-specific solution, what evidence would an implementer want/need to collect on their use of this?

Evidence Review

- Identify where more research is needed, including determining whether the solution can work for a given context (and where it might not).
- Consider evidence from literature, group experiences, other sources

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C. Context of the challenge

Individual learner context

Understanding that interaction with other people is necessary (instructors and peers), and learning won't be a solitary process

Context for groups of learners

Participants' individual learning is directly associated with their investment in others' learning

In the online world, there's potentially lower engagement than in-person because people aren't immersed, can be distracted by their daily lives, etc. Which can, in turn, be a detriment to others' learning.

Context for individual instructors

Participants come from all over world and have different classroom expectations and cultures that they're used to

Participants may be interdisciplinary (or not), and may have similar scientific backgrounds and knowledge (or not)

Participants are PhD students and above (grad students, postdocs, faculty, and professional research scientists) who are often self-motivated because they're learning skills directly relevant to their research

Context for training modalities

In-person or online

Many different in-class approaches are needed (lecture, small-group work, large group discussion, hands-on, etc.) and people must agree to work together

Other unique circumstances

Instructors are often experts in their fields, not necessarily experts in education or inclusion

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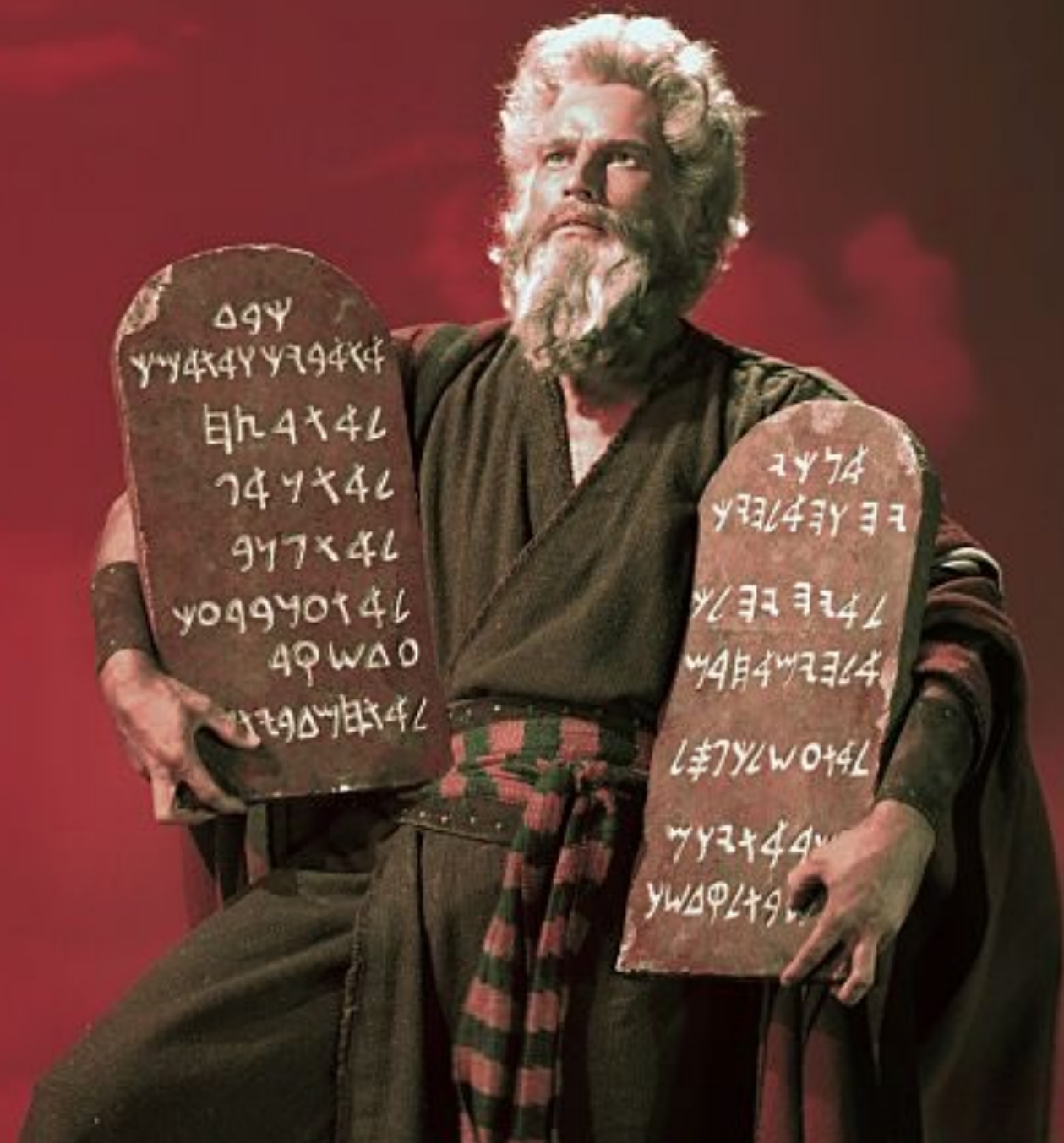
Context for individual

Context for training

Other unique circumstances



The Principles...



Δ9Ψ
ΥΥ4X4Y Y794X4
Eh 4x4L
74 Yx4L
9Y7x4L
Y099Y0x4L
4QWΔ0
7x4LΔ6x4L

2Ψ7Δ
YEYE7EY E E
74E E E 74
47E4E4E4E
Lx7Y/W0x4L
Y Y2x44Y
YWΔφLx4L

The Principles

- Label and capture the best of what many (but not all) do

The Principles

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- Provide a path for individuals or groups to develop a predictable experience

The Principles

- Label and capture the best of what many (but not all) do
- Provide a path for individuals or groups to develop a predictable experience
- Enshrine values and practices which may get lost due to scarce resources (time, experience, awareness)

Core Principles

All short-format training should...

1. Use **Best Evidence**; grounded in findings from the education sciences and formally evaluated instruction.

Core Principles

All short-format training should...

2. Promote **Catalytic** learning; prepare learners to succeed when the application of knowledge, skills, and abilities requires further self-directed study.

Core Principles

All short-format training should...

3. Be **Effective**; provide evidence (i.e., from assessment, evaluation) to learners that they have made progress in achieving programmatic and learning goals.

Core Principles

All short-format training should...

4. Be **Inclusive**; maximize the ability of all learners to participate in and benefit from the learning experience.

Community Principles

Communities increase the impact of short-format by working to ...

5. Reach: include new types and larger audiences of learners.

Community Principles

Communities increase the impact of short-format by working to ...

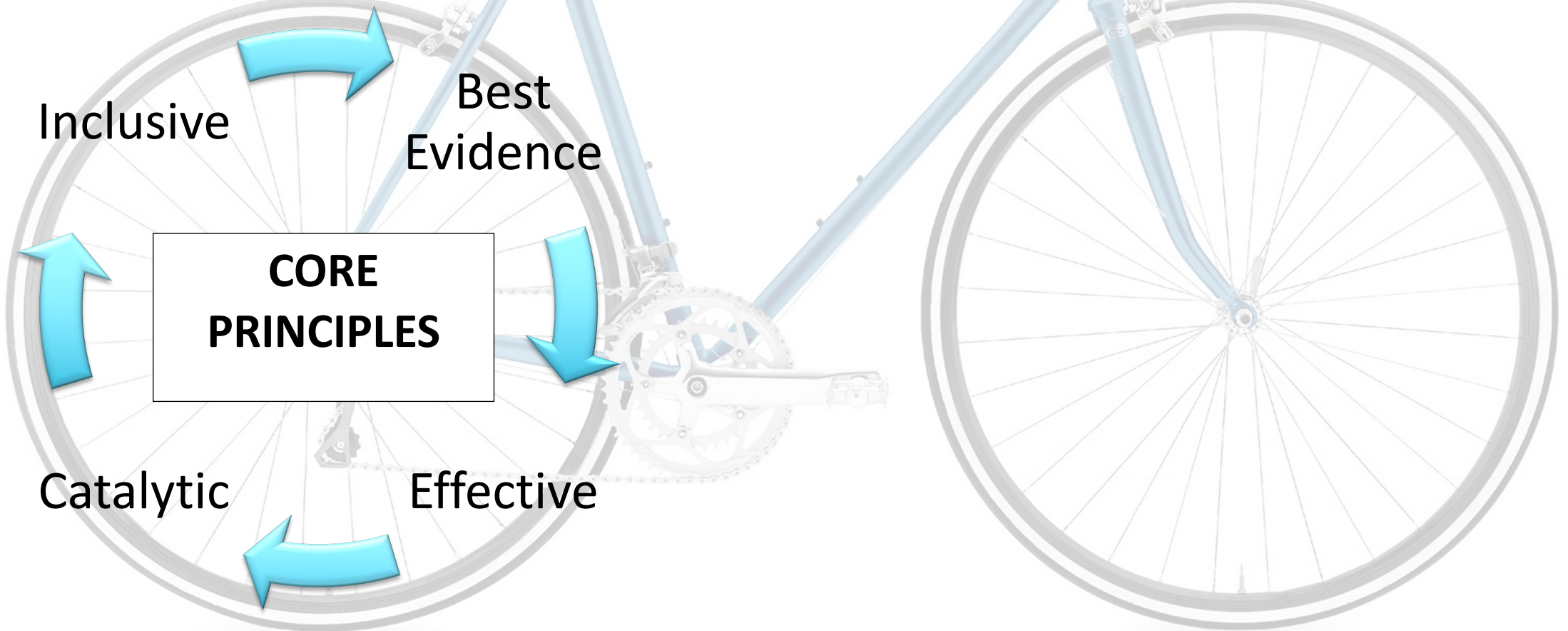
6. Scale: increase delivery of short-format training by new groups and larger numbers of instructors and instructional developers.

Community Principles

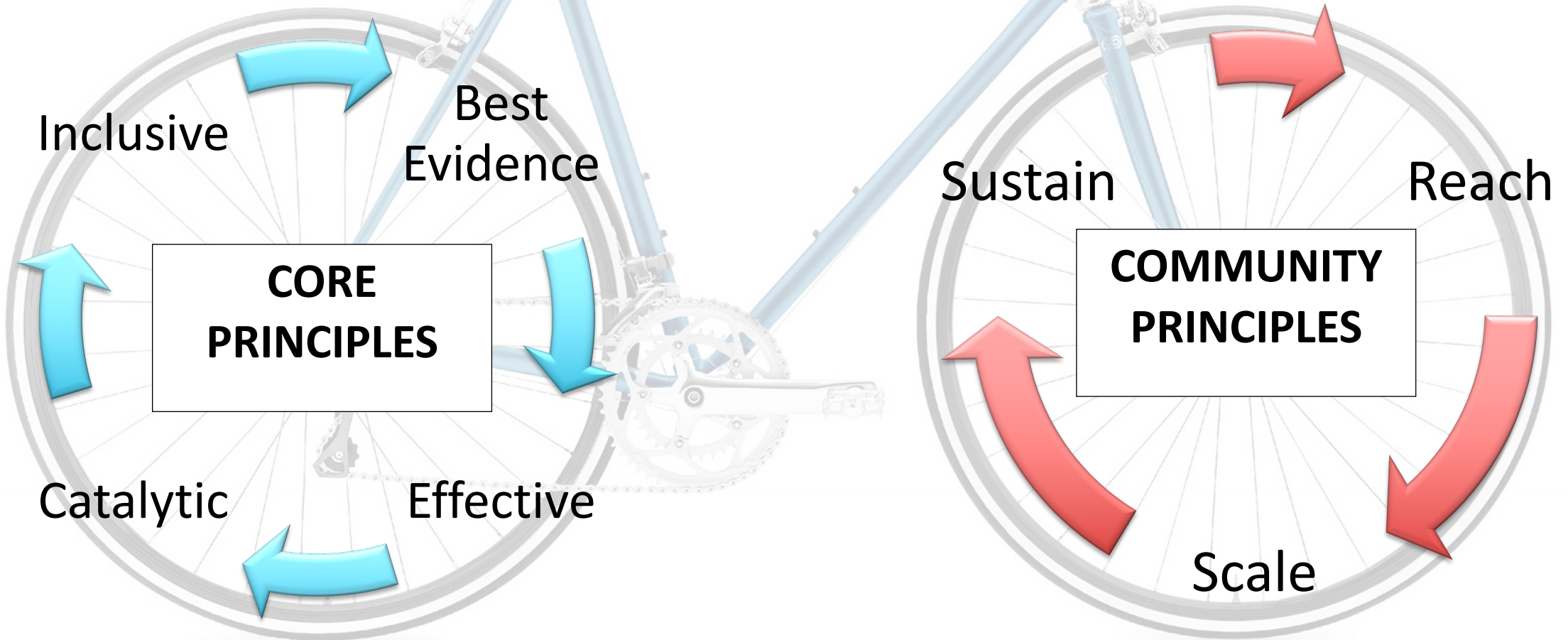
Communities increase the impact of short-format by working to ...

7. Sustain: work to maintain the availability, usability, relevance, and reliability of learning materials as well as supporting the supporting infrastructures, trainers, and communities which enable effective and inclusive training.

“The unicycle” – fine for going alone



“The bicycle” – good for going far



Recommendations to implement...



Ferdinand Pauwels - Luther hammers his 95 theses to the door

scientist in a lab coat riding a bicycle



This artwork was created with the help of Artificial Intelligence. Create your own AI-generated artworks using [NightCafe Creator](#).

A. Professionalize the training of short-format training instructors and instructional designers



Doctor studying a textbook

B. Centralize infrastructure for short-format training assessment and evaluation



scientist measuring an experiment

C. Support microcredentialing of short-format training instructors



Female student receiving a diploma

D. Operationalize equitable and inclusive practice in short- format training as an ethical obligation



Large crowd of people having fun

E. Deploy short-format training to counter inequity



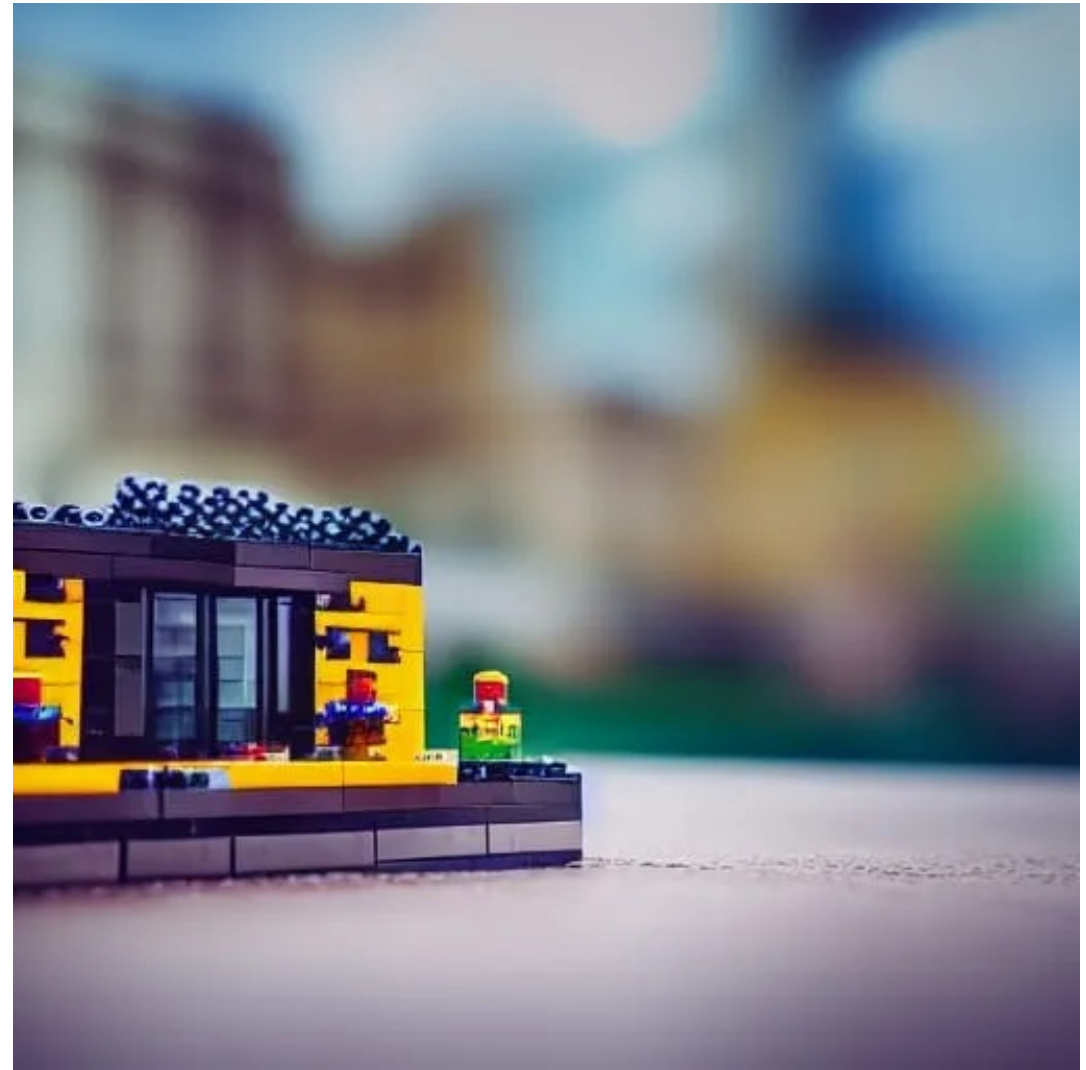
Judge in robe fighting for justice

F. Make the *Bicycle Principles* actionable for funders



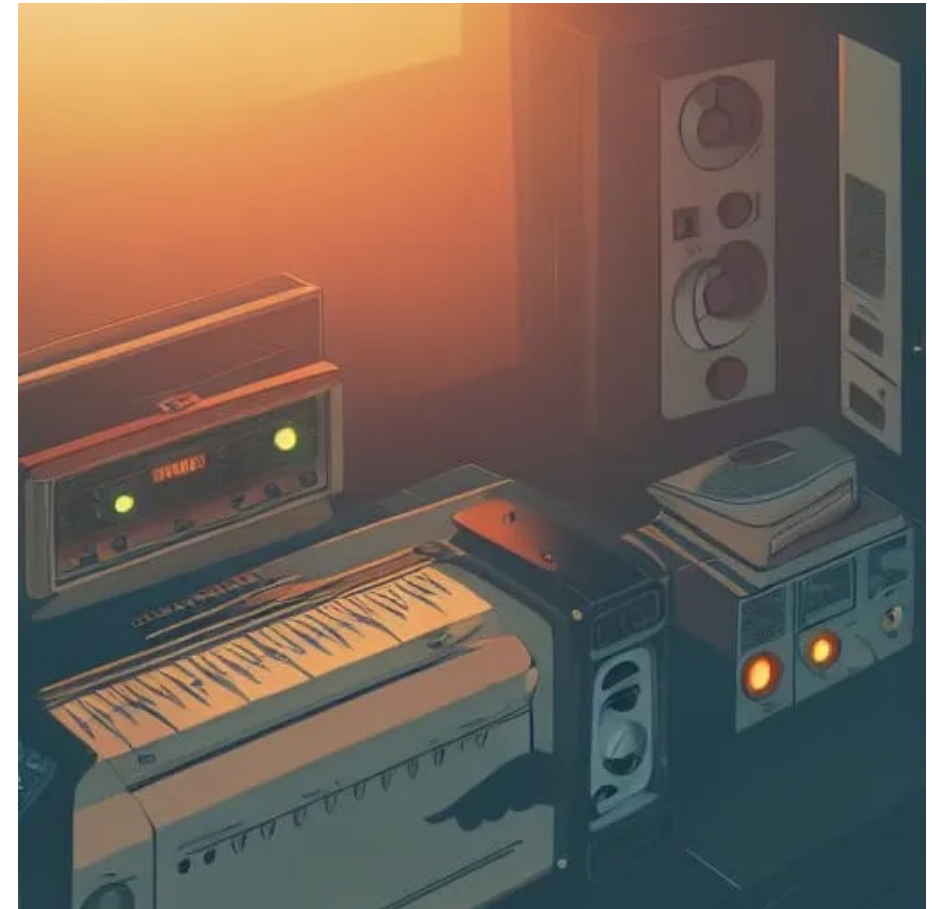
Gold Bicycle

G. Clarify the economic models that enable short-format training



Bank made from Legos

H. Document models for high-fidelity reaching, scaling, and or sustaining of short- format training



High-fidelity radio set

I. Apply FAIR principles to training materials



People sharing lollipops

J. Encourage interoperable short-format training registries



Person signing a guestbook

K. Communicate standards of instruction through badging



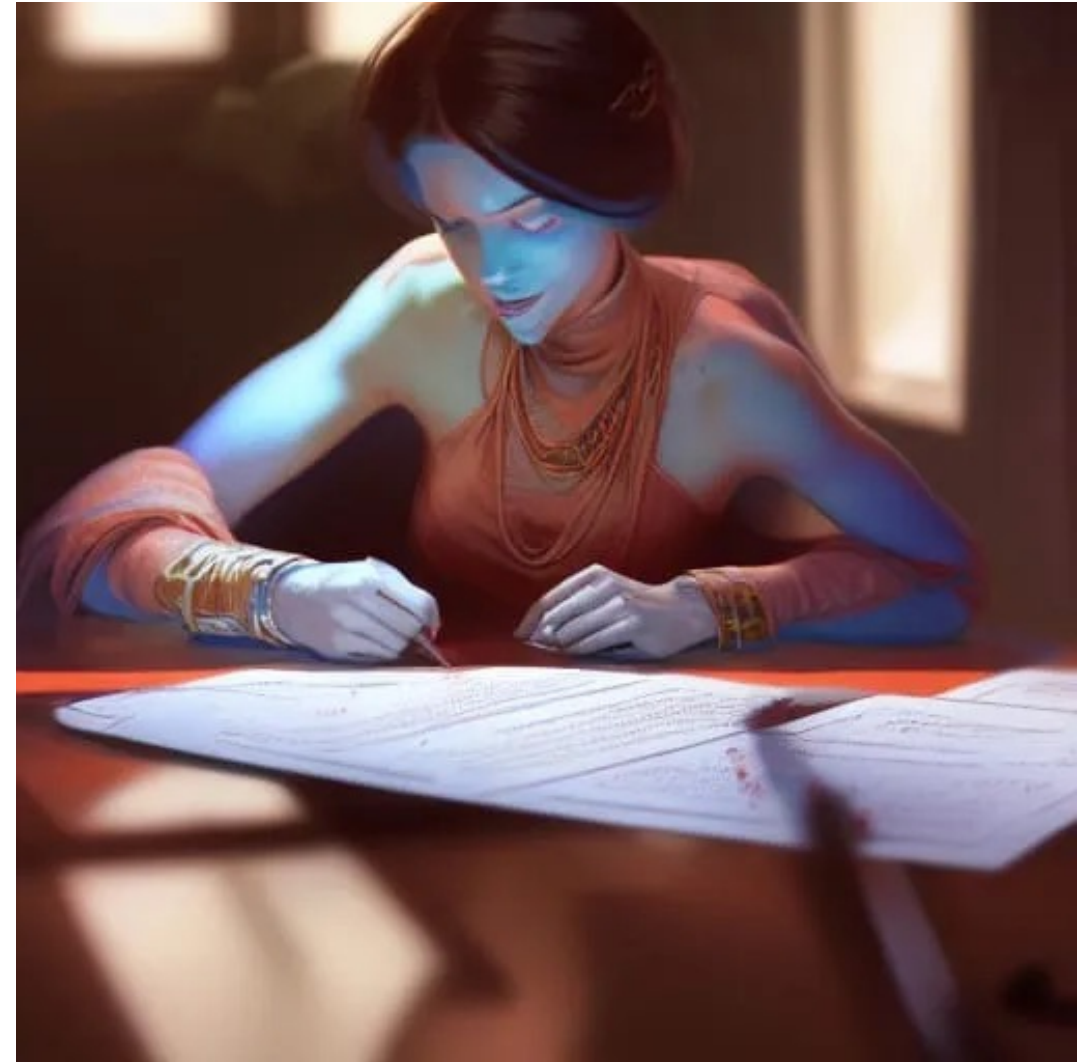
Scout earning a badge

L. Develop an implementation strategy for *Catalytic Learning*



Chemistry lab explosion

M. Support integration of diagnostic assessment into short-format training



Grading a test

N. Encourage evidence-based guidance to support career-spanning learning



Futuristic trail map

Sharing these ideas...



GitHub

Introduction to the Recommendation... [Next >](#)

Home

▸ Recommendations and Surveys

Glossary and Definitions

Community Feedback and Next Steps

The Bicycle Principles for Effective, Inclusive, and Career-spanning Short-format Training

Improving Professional Development in the Life Sciences and Beyond

Announcement

July 2022

Please take the survey: Let us know what you think about the recommendations to improve short-format training. Each [recommendation](#) has a survey question to provide anonymous feedback.

Visit the [feedback forum](#) to ask questions and start conversations. Join this low-traffic [mailing list](#) for updates.

The need for a community-driven principle-based framework



bikeprinciples.org

v1.0.2 - July 2022

Search

GitHub

Home

- Recommendations and Surveys
 - Introduction to the Recommendations
 - Survey Instructions
 - A. Professionalize the training of SFT instructors and instructional designers**
 - B. Centralize infrastructure for SFT assessment and evaluation
 - C. Support microcredentialing of SFT instructors
 - D. Operationalize equitable and inclusive practice in SFT as an ethical obligation
 - E. Deploy SFT to counter inequity
 - F. Make the Bicycle Principles actionable for funders
 - G. Clarify the economic models that enable SFT
 - H. Document models for high-fidelity reaching, scaling, and or sustaining of SFT

A. Professionalize the training of short-format training instructors and instructional designers

Summary:

Creating a professional society(ies) or communities of practice dedicated to SFT could support instructors, instructional designers, and instructional administrators as well as helping to extend the reach of the *Bicycle Principles*.

Instructors, instructional designers, and instructional administrators could benefit from the services provided by professional societies (e.g., a venue for self-identification, shared affiliation; dissemination of work; development of practice; rewarding of outstanding contributions). Instead of being a "special interest group" splintered from a specific professional society, this could be an independent, cross cutting, professional community. Such a group can promote appreciation for the professional competency of effective SFT instructors. It could also positively influence the entire scientific community by promoting effective and accessible training principles worldwide. Such a group could focus on training to assist SFT instructors and instructional designers to reach specific standards. Since most professional associations already have instruction-focused special interest groups, there is evidence many people would be interested. Furthermore, existing but unconnected groups around the world already have formal, iteratively-improving trainer-training programs in which new instructors engage.

- **Summary:** Expands upon what problem the recommendation tries to solve.
- **How might this work:** Brief implementation example and suggestions on evaluating success.
- **Related Principles:** Most closely related *Bicycle principles*.
- **Benefits to the learners:** How recommendation helps learners (directly or indirectly).
- **Incentives to Implementers:** Motivations for implementers to enact this recommendation.
- **Barriers to Implementation:** Obstacles that may hinder this recommendation.

Survey question


After reading the [survey instructions and consent page](#) and the recommendation above please rate and leave feedback using the survey questions below:

Bicycle Principles - Recommendation J: Encourage interoperable short-format training registries

* 1. Which of the following roles best describes how you'll give feedback on this recommendation?

- As a learner (someone who mostly attends short-format training)
- As an SFT instructor (someone who mostly teaches short-format training)
- As an SFT instruction designer (someone who mostly designs short-format training curriculum)
- As an SFT instructional administrator (someone who mostly hosts and supervises short-format training)

0 of 2 answered

powered by  SurveyMonkey

Create your own user feedback survey

What stakeholder are you?

How do you rate:

- Benefits to learners
- Incentives to implementors
- Barriers to implementation
- Your likelihood to implement

Building the community (next steps)...

Bicycle Principles Community Feedback Forum

We invite **STEM Learners, Instructors, Funders, and other Stakeholders** to help make *The Principles* actionable

We seek to stimulate community-driven discussion as well as be informed by and react to feedback. By use of this forum, you consent to the inclusion of aggregated and anonymized comments in the use of publications developed by the Banbury Working Group (Principles Authors). For specific contributions, we will seek permission and to properly credit. Please reach out to williams@cshl.edu if you'd like to participate or comment in some other way.

[Index](#)

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Bicycle Principles Discussion



Start a New Topic

Topic	Author	Views	Replies	Last Post
Welcome!	Jason Willi...	7	0	Jul 9, 2022 12:55pm by Jason Williams

[Index](#)

bit.ly/bikefeedback22



- Survey
- Focus groups
- Feedback forum
- Mailing list
- Preprint/publication
- Webinars

Share and join in!

“The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn”
– A. Toffler

Thanks!



Cold Spring Harbor Laboratory
DNA LEARNING CENTER



CYVERSE™



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