REFLECTING ON PRACTICE FOR STEM EDUCATORS

A Guide for Museums, Out-of-school, and Other Informal Settings

LYNN UYEN TRAN AND CATHERINE HALVERSEN

COMPANION @ WEBSITE

ROUTLEDGE

Reflecting on Practice for STEM Educators

Reflecting on Practice for STEM Educators is a guidebook to lead a professional learning program for educators working in STEM learning environments.

Making research on the science of human learning accessible to educational professionals around the world, this book shows educators how to relate this research to their own practice. Educators' collective work broadens the scope of an organization's reach, and through this effort, the organization grows its social capital in its local community and beyond. This book offers opportunities to engage in processes that lead toward organizational learning by attending to the professional growth of the educators. Tran and Halversen show how learning together can shape the language and meanings by which educators do and talk about their work to support visitors' experiences. The book provides guidance on how teams of educators can build community as they engage in reflective practice.

Reflecting on Practice for STEM Educators will be essential reading for leaders of any organization that aims to educate and engage the public in science, technology, engineering, and mathematics. It will be particularly useful to educators who work in museums, zoos, aquariums, botanical gardens, youth organizations, after-school programs, and nature, science, and conservation centers.

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Reflecting on Practice

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Preface

This guidebook puts into practice the *Reflecting on Practice*™ program that was developed at the Lawrence Hall of Science, University of California, Berkeley by the authors. It was grounded in Tran's areas of scholarship in the work, knowledge, and identities of informal science educators. It was inspired by Halversen's work teaching scientists, formal and informal educators, and undergraduate science students how to communicate science based on how people learn. The authors garnered multiple federal grants over the years to develop, test, refine, and disseminate the program and written curriculum. Hundreds of educators from informal science education organizations (predominantly across the US) have used this curriculum to implement *Reflecting on Practice* with their colleagues, transforming the ways they engage with the many thousands of learners they reach annually. This guidebook enables the authors to make the materials and program more broadly available to the informal science education community globally.

As our field recovers from the coronavirus pandemic of 2020, rebuilding our workforce must include dismantling structural racism. That work requires constant reflections and learning, both individually and collectively. We hope this guidebook can be a useful resource towards that effort.

The Lawrence Hall of Science
UNIVERSITY OF CALIFORNIA, BERKELEY

ROP
Reflecting on Practice

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Credits

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Introduction

Reflecting on Practice is a professional learning program designed for educators in informal science learning environments. It's intended for organizations to adopt and implement themselves. This book guides educational leaders within an organization to facilitate experiences with colleagues to engage in ongoing learning about their practice.

Experiences described in this guidebook make research on learning and teaching science available for educational professionals to talk about, reflect on, and apply to their practice. Staff at the organization learn together and from one another, and in the process negotiate meanings and develop shared language by which they talk about and do their work to support learning. This program requires commitment from both the organization and individuals. Management in the organization offers time, resources, and freedom needed for professionals to learn, while individual participants remain open-minded and willing to scrutinize their practice and change as they learn. Over time, new leaders within the community emerge to lead colleagues at the organization through *Reflecting on Practice*, and the cycle continues. Thus, cultivating leadership capacity from within is inherently built into this program.

The goal of *Reflecting on Practice* is to **advance the informal science education field by cultivating communities of learners among its professionals**. In support of this goal are three key objectives:

- Build shared language and understanding among professionals by delving into research on learning and teaching.
- Engage practitioners in habits of reflection through observing their own teaching, to develop their practice and make it public.
- Nurture a tradition of continued professional learning among participants, and thereby build a professional learning community.

Learning as Professionals and Why it Matters

Few would disagree that workforce learning is a necessity for organizations to stay competitive, especially in knowledge-based work like education. What remains elusive is how learning is positioned and enacted within the organization. In workplaces, the key objective is not learning, but rather successful delivery of their goods and/or services (Unwin, 2004). In education-focused organizations, like museums and universities, those goods and services are learning experiences, but for their patrons, not their employees. Learning happens for employees because humans are social organisms who learn as we participate in social activities (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). Work is a prominent social activity throughout our lifetime, especially in adulthood. Thus, places of work are places of learning, regardless of whether workers and managers consider the workplace as such. As we participate in our social activities, humans learn by imitation,

collaboration, and instruction (Bransford et al., 2006; Meltzoff & Decety, 2003; Vygotsky, 1978; Wood, Bruner, & Ross, 1976); in work environments, the ways that learning happens have been described as informal, incidental, and formal (Elkjaer & Wahlgren, 2005; Marsick & Watkins, 2001).

While efforts to identify direct correlation between staff development and organizational performance have fallen out of favor (Unwin, 2004), the desire for improved performance from investments in staff remains. Understandably, it's valuable for learning acquired by individual staff to transfer to the organization. What's inappropriate, however, is how learning for staff is often viewed and carried out (Tran, Gupta, & Bader, 2019). Entrenched in traditions of workforce development and organizational management, staff development has common features that are counterproductive to learning or transforming practice. Learning is situated as separate from working—*if they're learning, they're not doing their work*; thus, staff development is typically treated as a burdensome transaction that's undertaken to remain competitive. Staff learning is approached from a deficit perspective—*if they know this, they'll be better at their job*; thus, discrete trainings to "fix people" are offered. Learning experiences are usually one-way transmission of information—*let me tell you what you need to know*; thus, demonstrating the flawed association that telling is teaching. Learning opportunities are available hierarchically—*managers first*; thus, reserving opportunities to those in positions of power. Education-focused organizations aren't immune to these approaches towards workplace learning.

We consider learning at work from another mindset: the workplace is a learning environment and learning occurs through participation in the social practices of work (Billett, 2004). This broader viewpoint on learning is foundational to educational work in informal science learning environments but is rarely extended to the staff in the organization. Figure 1 illustrates how different areas of scholarship in learning and teaching are structured in the *Reflecting on Practice* program. This guidebook is a curriculum for workplace learning (Billett, 2002); staff learn as they participate in doing their work and talking about what they're doing. We position the educational professionals who participate in the program as learners, learning about their own work. They're partaking in professional learning, which is fundamental to developing expertise in any profession (Webster-Wright, 2009). The **science of human learning** is at the heart of the program (and

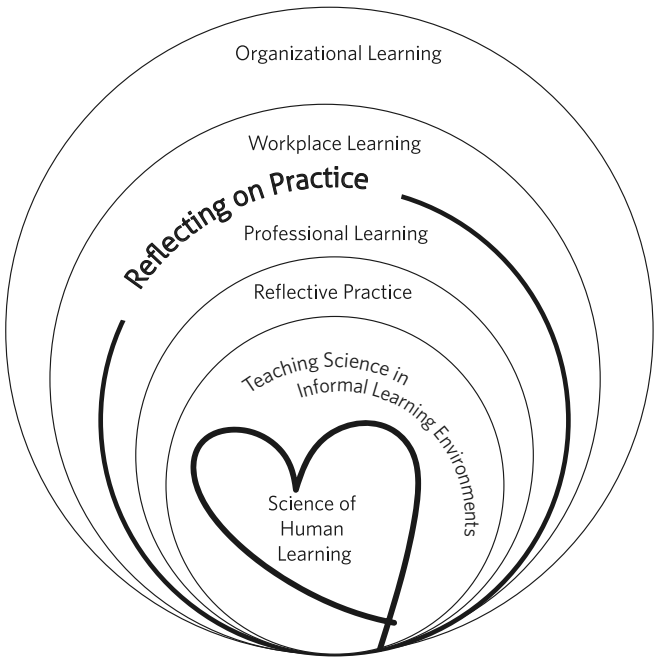


Figure 1. Areas of scholarship in the *Reflecting on Practice* program.

guidebook). Participants explore this content on learning and consider how to use it in their practice as they teach science in informal learning environments; we use this content to inform design of the experiences. Facilitators of this program must also use this content to support their staff's learning. Learning about their practice entails engaging in reflective practice, individually and with colleagues. Participants negotiate meanings and language to talk and think about their work, and make connections across experiences. Facilitators who use this guidebook with their staff, learn alongside their colleagues. As the community learns together, the learning gains and knowledge cycle between the individuals and the organization (Crossan, Lane, & White, 1999).

It's convenient to treat this guidebook as a well-designed training program for new or temporary staff. Indeed, it can be sensible to take such a restrictive approach towards workplace learning for seasonal staff hired to do discrete work (Fuller & Unwin, 2004). However, limiting usage of this guidebook as training material for onboarding sells short the potential. Stories from places that have adopted the program demonstrate the long-term potential (Tran et al., 2019; Tran, Werner-Avidon, & Newton, 2013). This program and guidebook are designed to cultivate communities of learners and habits towards mastery among professionals within an organization (Chadwick & Raver, 2015), and facilitate learning and knowledge creation to move from individuals into the organization and back again (Crossan et al., 1999). Ultimately, the community and habits you cultivate, and the learning gains your organization achieve through this program, are yours to keep.

Learning from Individual to Organizational, and the Structure of this Guidebook

An important issue in organizational learning that needs to be explored pertains to transfer of learning from the individual to the organization. While calculating whether *this amount of investment* in staff will yield *that amount of return* in their work is a futile exercise (humans aren't robots!), it's necessary to put our energy into ensuring pathways for learning to move from individuals to the organization. Learning is done by humans, not organizations. The organization benefits from the learning gains only when people can apply what they learned into how they do their work, and those gains endure when they're shaped by the community and become artifacts of the community. The organization "learns" when people enact changes from what they've learned and those new ways of doing and thinking become systematized, taken-for-granted patterns. Consequently, organizational learning falls short if the individual's learning isn't attended to appropriately.

Valuable learning occurs incidentally and informally at work (Marsick & Watkins, 2001), but we shouldn't rely exclusively on happenstance (Billett, 2004). If there are learning outcomes desired in the workplace, then intentional pathways can be designed to support them. Crossan, Lane, and White (1999) offer a useful, multi-level framework to conceptualize organizational learning that links the three levels within organizations (individuals, groups, and the organization) based on four social and psychological processes (intuiting, interpreting, integrating, and institutionalizing). These processes inform each other to lead to organizational learning. **Intuiting** is "the preconscious recognition of the pattern and/or possibilities inherent in a personal stream of experience" (p. 525) that happens individually; it affects others if they interact with the individual. **Interpreting** is the process of explaining a new idea to oneself and others through words or

actions, which can occur at both the individual and group levels. **Integrating** is the process through which a shared understanding is developed among individuals and coordinated action is taken through mutual adjustment, and this process takes place at the group and organizational levels. **Institutionalizing** occurs at the organizational level when routinized actions transpire or become part of the taken-for-granted patterns.

Figure 2 illustrates how we envisage this framework in the *Reflecting on Practice* program; the three circular objects are each a level, bolded text are the processes, solid arrows represent experiences in the guidebook that facilitate flow within and between the processes, and the broken arrows offer the potential for feeding back from the institution to other processes and levels. The tasks, exercises, and tools (structures) in this guidebook offer opportunities to engage in these processes in a deliberate way. Table 1 lists which type of processing each of the structures generally support. Every session includes a combination of these structures, described briefly in the suggested session agenda.

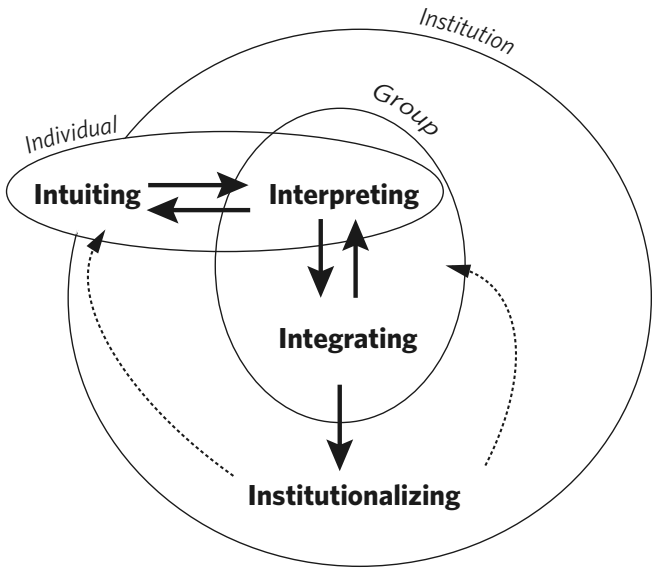


Figure 2. Application of Crossan, Lane and White's (1999) multi-level framework on organizational learning in *Reflecting on Practice*.

Table 1. Type of social and psychological processing generally supported in the tasks, exercises, and tools in *Reflecting on Practice*.

Reflecting on Practice			
Level	Process	Tasks	Exercises & Tools
Individual	Intuiting	• Hands-on • Continue the Learning	
	Interpreting	• Retrieve & Connect	• Learning Journals
Group		• From Learners' Perspective	• Reflection Worksheets
		• Research Discussions	• Video Reflections—presenter
	Integrating	• Let's Talk Practice	• Educator Moves • Video Reflections—peers • Institutional Practices
Organization	Institutionalizing		• Design and Teaching Tools • Tools for Reflective Practice

There are 12 sessions (~2.5 hours each) detailed in this guidebook, organized into four modules that examine topics (learning, prior knowledge, conversations, objects and design of learning experiences) relevant to educational practice in informal science learning environments. There are two **interactive** sessions and one **reflective** session in each module. The tasks and tools in **interactive sessions** engage participants in reflections and discussions on learning and teaching—both drawing on their personal and professional experiences and integrating research from many disciplines, including psychology, education, and sociology. The tasks are enacted through various Thinking Routines that make learners' thinking recognizable and visible to themselves and others. Participants express their beliefs and understanding, review their habits and assumptions, consider applicability of ideas from research, and determine ways to change their practice.

Reflection sessions are occasions when the community meets to present samples of their work and provide feedback on that work, in both small and whole group. Video is the primary type of work sample reviewed in this guidebook. By using video clips of their real-world interactions to reflect on their practice and draw on facilitated observations and feedback from colleagues, participants experience profound change in their teaching habits and mindsets. ***Reflecting on Practice*** **Tools for Reflective Practice** are designed to make the process, roles, and responsibilities known to all. This transparency is intended to let everyone know what to expect and what is expected of them.

Learning Content in Service of Equity and Justice

Informal science learning environments have gained recognition as important cultural institutions—places to learn about science, develop career aspirations in science, and cultivate interest and enjoyment in science with family and friends (Ellenbogen, Luke, & Dierking, 2004; Falk & Dierking, 2010; Lehr et al., 2007). There is also growing acknowledgement that these same environments aren't equally beneficial and inviting to all. Typically, the staff is predominately white and middle class, as are the usual visitors (Dawson, 2014a). Learning experiences often favor English language practices and Western representations of science and people in exhibits, signage, etc., excluding members of ethnic groups and competing ways of knowing (Ash, 2004; Garibay, 2009). The physical spaces are structured in ways that tend to exclude the needs of people with disabilities (Sandell, Dodd, & Garland-Thomson, 2010). Ways to explore and navigate the space may reinforce social disadvantages for some visitors (Dawson, 2014b). Collectively, this research shows how the education sector isn't impervious to society's inequities and injustices, nor is it entirely innocent from perpetrating acts that inflict undue harm on marginalized communities.

Education, whether in formal or informal environments, exists within the sociopolitical context. It's part of society's system, which means it affects and is affected by what happens in society. With this awareness comes the need for educators to understand oppression in individual and systemic terms, and realize the implications on how they do their work; simply treating everyone the same

won't make limits to equal opportunity disappear. It's also important for educators to understand power in personal and social terms, and how to exercise their power responsibly. Without socially conscious interrogation, there is risk of reducing equity pedagogies to a list of strategies to check off or focus on celebrating culture over transforming curricula (Sleeter, 2012). These familiar actions reveal the flawed assumption that valuing learners' cultural diversity will solve the problems of systemic inequities. In short, despite their good intentions, educators can't achieve the positive impacts they desire if they aren't engaging in critical conversations. To engage in such conversations requires educators' willingness to reflect upon themselves and to sometimes be uncomfortable.

Certainly, informal learning environments are just one component in the larger system of society, and educators are just one group in the larger organizational system. However, we're also not entirely powerless. As organizations and individuals, we can **choose to be critically conscious** of how injustices are perpetuated, both through individual and institutional actions. We can **choose to enact change** where we can. Taking action involves hard choices concerning organizational structures that perpetuate inequities and exclusion, such as governance, funding, hiring practices, leadership development, etc. In educators' daily practices those choices include, but aren't limited to, how they: design learning experiences, interact with learners, and treat one another. Those choices rely on the strength and mindset of the community because the work towards equity and justice is difficult and ongoing.

The content featured in this guidebook is focused on how people learn and how to support their learning, which is of value for all learners. However, the critical conversations on social inequalities in education necessary to truly uplift all learners aren't brought forth explicitly. The work towards equity and justice is extensive and requires everyone's attention through multiple pathways. There's no single solution to address the systems-level change needed. This guidebook can be used in service of the larger effort to teach for equity.

- **The learning content.** The guidebook emphasizes looking at learners' prior knowledge as places of strength, rather than deficit (Module 2). This mindset is critical in teaching for equity because all learners—not just those from privileged backgrounds—have useful resources that are the foundation for their learning. Helping learners to see and appreciate their own strengths and talents requires educators to see it, too. This guidebook stresses the significance of talking when learning, and fosters skills to invite learners to talk, and for educators to listen closely when learners speak (Module 3). This ability is crucial in teaching for equity because we can't truly care for all our learners' well-being and academic success if we don't know how to make space for them to express themselves or are unable to listen to them with whole-heart and open-mind. Without this understanding, we also won't be able to recognize this need within our community as we learn together. This guidebook pushes on using objects to support learning and urges critical examination of how we design learning experiences (Module 4). This habit of scrutiny is essential in teaching for equity because we need to know how to intentionally design our learning experiences to support all learners.

- **The culture and community.** This guidebook routinizes reflective practice, productive feedback, and collegial discourse as "the way we do things here." These routines as taken-for-granted patterns for work are fundamental to teaching for equity because the work towards justice requires self-interrogation, intergroup dialogue, and ongoing learning within a community. Encouraging educators to engage in the hard work needed to make equity and inclusion a part of their practice entails raising their social consciousness and normalizing critical dialogue among colleagues during their daily work where and when things happen, not relegating them to occasional, training meetings led by outside experts. This guidebook aims to build the culture and collegiality among peers that enables its members to grow and be responsive. A culture that's driven by growth and understanding may be more willing to confront the difficult questions needed to challenge systems of oppression and injustice. A community with strong social relationships among its members may be more resilient to the uncomfortable conversations that need to occur to actively challenge all forms of injustice through and in education.

Using this Guidebook, Implementing this Program

This guidebook is a comprehensive resource for busy professionals like yourself to enact with your colleagues. Additional examples and other planning documents for implementation are available as digital resources in the Companion Website.

Composition of your community. *Reflecting on Practice* is intended for educational professionals across the spectrum of experiences, qualifications, work-type, and audience-focus throughout your organization to learn together. Depending on the size, structure, goals, and needs of your organization, the community could comprise: five to 50+ people; staff from one or multiple departments; predominantly educators or include administrative support and animal caretakers. Be aware, if implementation is treated as "training" rather than professional learning, those with advanced degrees and/or years of experience will feel it's inappropriate for them, and then your community wouldn't benefit from their insights.

Facilitation team. Ideally, a team of at least two leaders and/or emerging leaders should facilitate the program. Given that the facilitators participate in the program while also leading and coaching their colleagues, it's best to have a learning buddy. The program has the potential to build leadership capacity from within your organization, so facilitators needn't be directors of departments exclusively. Consider an apprenticeship approach for the facilitation team, as well as using it to disrupt standard practices for leadership building. Be aware, facilitators need to be appropriately supported to be/become leaders by their colleagues, otherwise, undesirable social dynamics can overshadow the learning opportunities.

How the guidebook is organized. We've intentionally provided extensive details so that it's easy to use. Although not a recipe for how to teach, teaching is modeled throughout the experiences. Notes in the margins offer explanations and clarifications as you consider making adjustments; it'll be

helpful for you to articulate why your changes make better sense for your community. Module 1 Session 1 has extra notes to elaborate further on components in all sessions. Details in each session include the following, in order of appearance.

- **Overview** and **Objectives**
- A suggested **Agenda**—annotated with descriptions and estimated time for each task
- **Materials**—what's needed, including all hands-on materials and copies of handouts
- **Getting Ready**—detailed instructions to prepare to facilitate, including:
  - readings and reminders for the facilitator to review,
  - reminders and suggestions for participants before the session,
  - preparing materials and web links for use during the session,
  - readings and assignments for participants to **Continue the Learning** (unless specified, all readings are free and downloadable from The National Academy Press, www.nap.edu), and
  - advance preparation for upcoming sessions.
- **Step by Step**—detailed directions for facilitating discussions and activities. The sidebar includes thumbnails of each handout for easy reference, and a projector icon denotes when to display corresponding PowerPoint slides (found on the Companion Website). Tasks and Routines are called out throughout the Step by Step, helping the facilitator to monitor and be mindful of the purpose and objectives of each part of the session and learning progression.
- **Handouts**—readings and examples specific for a session are included within the session; tools, processes, and worksheets used in multiple sessions are found in the appendices. All the handouts can be duplicated for educational use.
  - **Appendix A: Tools for Reflective Practice**—includes tools and processes for making, observing, and discussing videos and other work products during Video Reflections.
  - **Appendix B: Design and Teaching Tools**—includes tools (such as Thinking Routines) and worksheets for designing effective experiences based on the frameworks and pedagogy introduced, discussed, and practiced throughout the *Reflecting on Practice* program.

Digital resources helpful for facilitating this guidebook are stored on the publisher's Companion Website (www.routledge.com/CW/Tran). These items include digital copies of the handouts, basic PowerPoint slide deck, implementation examples, etc.

MODULE 1.
Learning, Reflections, and Science

Overview

Module 1 introduces participants to the design and theoretical foundations of the *Reflecting on Practice*™ program. They learn that the program is an opportunity for practitioners with all levels of experience to learn from one another, develop shared language on educational practice, deepen their knowledge on the science of learning, and exchange ideas on how they teach.

Session 1 introduces the program and commitments, and presents **foundational ideas on learning** that will be explored throughout the program. It introduces tasks and routines integral to the program, including **research discussions** to relate their experiences and thinking to research; and **hands-on activities** designed to be engaging and challenging experiences for adults to think about learning and teaching.

Session 2 engages participants in **discussions about professional learning and reflective practice**. It introduces them to the **professional learning community** framework and the reflective tasks that are part of the program, with a special focus on observing and analyzing videos of one another's practice in **Video Reflections**. Participants practice using the **tools and processes** in their first Whole-Community Video Reflection.

In Session 3, participants gain insight into the **nature and practices of science** in the best way possible: by *doing* and *reflecting* on science. They explore, "What is science?" and "How does science work?" The conversation deepens with ideas on common misinterpretations of science, how science is one way of knowing, and young people's science aspirations and identities.

Module 1.
Session 1: Learning Beliefs, Behaviors, and Goals

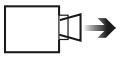
Session Overview

This session serves as an introduction to the *Reflecting on Practice* program. It opens discussions about **how people learn** by introducing foundational ideas on learning. It also highlights the important contributions of **informal science learning environments** as places where people come to learn and develop interests in science. Participants learn about the major components of the program, and determine how they themselves will be involved and what their commitments will be.

Session Objectives

- Identify personal beliefs on learning, behaviors in learning, and goals for learning.
- Discuss the complexity of learning, and how this complexity pertains to learning and teaching science in informal environments.
- Determine personal goals and agendas for participating in the program.

SESSION AGENDA		
Task **Routine**	**Description**	**Estimated Time (in minutes)**
Introduction (Part 1) *Goals and Objectives of* Reflecting on Practice	Goals and purpose of the program are introduced and Learning Journals distributed.	5
Retrieve & Connect Thought Swap: *Getting to Know Each Other*	First with a partner and then with the whole group, participants share ideas on a series of questions about (a) informal science education and (b) teaching and learning goals.	20
Introduction (Part 2) *The Program and Session 1*	Overview of the program and Module 1 is presented. Objectives of Module 1 Session 1 are introduced.	10
Retrieve & Connect 3-2-1-Bridge: *Ideas on Learning*	Participants jot down initial ideas on how they think people learn. They will revisit these thoughts in a later session.	5
Retrieve & Connect Turn & Talk: *Learning Beliefs and Behaviors*	Participants share their beliefs and assumptions about learning as they "turn & talk" to someone next to them. A whole-group share-out follows.	10
Break option		10
Hands-on *Cup & Card*	Small groups are presented with a hands-on challenge activity to promote discussion about learning and pedagogy.	20
From Learners' Perspective Table Talk: *What did you learn? How did you learn it?*	Participants examine the activity they just completed from their perspective as a learner.	10
Research Discussion Walkabout: *Five Foundational Ideas on Learning*	Participants briefly discuss why beliefs about the effectiveness of aligning teaching with learning styles are not actually supported by evidence.	55
Let's Talk Practice Minute Paper: *Personal Goals for the Program*	Participants gather their thoughts and write down personal goals in their Learning Journals.	3
Continue the Learning	Participants discuss the parameters and expectations for tasks outside of interactive sessions.	2
	Total Estimated Time	**150 mins. (2.5 hrs.)**



Note. Keep a lookout for this projector icon throughout the Step by Step in all sessions. Each appearance alerts you to "display" the corresponding slide from the slide deck.

MATERIALS

Recurring for all Sessions

- Data projector
- White board or chart paper and markers
- PowerPoint slide deck for the session (see **Getting Ready** #1)
- Tape (masking or painter's)
- Sound-maker such as a bell, chime, and/or tambourine (for bringing groups back together)
- (Optional) Workshop materials kit for each table
  - Sticky notes, multiple sizes
  - Pens
  - Snacks
  - Fidget toys (e.g., modeling dough, Slinky®, etc.)

"Fidget toys" are sensory objects that people can use to focus concentration, relieve stress, displace anxiety, quiet their minds, and for many other reasons.

For this Session

- 5 chart paper posters for **Five Foundational Ideas on Learning** (see **Getting Ready** #11)
- 5 different-colored markers
- **Science Explanation for Cup & Card** (see Companion Website www.routledge.com/CW/Tran)

Note. Handouts used in a session are located at the end of the session's Step by Step or the Appendices. All handouts can be duplicated for educational use (also see Getting Ready #1).

For each participant

- Handouts (1 copy each)
  - **Key Ideas from the Literature: Five Foundational Ideas on Learning**
  - **About the Program: *Reflecting on Practice***
- 1 Learning Journal (see **Getting Ready** #5)
- (Optional) 1 folder to hold all handouts

For each small group

- 1 pan filled with water (about 13" x 9" x 6" deep or 33cm x 20cm x 15cm deep)
- 1 tray or box in which to place materials
- 5-7 pieces of thin plastic sheet, 2 different sizes (e.g., 3" x 5" and 5" x 8")
- 6-7 different types of clear containers, glass and plastic with different sized rim and volume (e.g., Erlenmeyer flask, wine glass, martini glass, water tumblers, small vase)
- Towel (for wiping up spills)
- ~ 50 coins of the same denomination (for the Coin Challenge)

Getting Ready

1. The publisher's Companion Website for this guidebook makes digital resources for facilitating these sessions easily retrievable. Find the website in the Support Material section for this guidebook at **routledge.com**. Digital resources include:
   - Basic **PowerPoint** slide decks for all sessions. Customize and insert additional slides as needed.
   - Digital copies of all the **handouts** (readings, tools, worksheets printed in this guidebook). Use for easier duplication when teaching.
   - Additional **Science Explanation** for hands-on activities. Reference as needed; determine whether to share with participants.
   - Additional **guidance documents** for implementing the program. Use for planning.
2. Send out a welcome invitation to all participants. The message should include the following types of information.
   - Gratitude. Thank participants for investing in themselves.
   - Support. Describe the organization's commitment to investing in staff.
   - Expectations. Share a brief description of time and anticipated commitment from participants. (This will be elaborated on further during the first session.)
   - Schedule. Provide a meeting schedule, if available (e.g., every other Wednesday from 2-5 pm from now until April).
   - Preparation. Distribute information to review prior to first meeting.
     - Read **About the Program: *Reflecting on Practice*** handout
     - Watch "**Learning styles & the importance of critical self-reflection**, Tesia Marshik" (TEDx Talks, 2015) (https://www.youtube.com/watch?v=855Now8h5Rs)
3. Review the handouts and slide deck for this session, and additional suggested readings.

   For the facilitator:
   - *How People Learn II* (Chapter 3: "Types of Learning and the Developing Brain").

Note. Basic slide decks are designed to complement the Step by Step details for each session. The slides include simplified instructions or text from the guidebook to use with participants during the sessions. These details are also just-in-time reminders for facilitators.

It might not be possible to "require everyone" to watch the video before the session. Make sure at least three participants (or 20% of the group, whichever is greater) watch at least the first 11 minutes of the video. This deliberate planning will make for a more productive collective recall to initiate the Research Discussion.

The learning content for each session is detailed in the text of the Research Discussions.

(continues)

(continued)

Unless otherwise specified, all readings are free and downloadable from the National Academies Press. Search for the following book titles at www.nap.edu:

- How People Learn (2000)
- How People Learn II (2018)
- Learning Science in Informal Environments (2009)
- Ready, SET, Science! (2008)
- Surrounded by Science (2009)
- Taking Science to School (2007)

The *Reflecting on Practice* professional learning program requires that both institutions and individuals invest time and resources for the professional growth of the participants. **Institutions adopt the program** and allocate time and space for staff to engage, learn, and test out new ideas. **Individuals participate in the program** and commit time and effort to reflect on, make public, and improve their practice.

- *Learning Science in Informal Environments* (Chapter 1: "Introduction").

Continue the Learning suggestion for participants:

- *Surrounded by Science* (Chapter 1: "Informal Environments for Learning Science").

4. Duplicate handouts.

5. If you've decided to supply the Learning Journals (spiral-bound notebooks, 3-ring binders, etc.), have them ready to distribute.

   The Learning Journal is a record book in which participants keep their written thoughts in one place. It's both a tool for learning, as participants make their thinking visible on paper, and for reflection, as participants review past entries to notice patterns and changes in their thinking.

6. Consider parameters and expectations for **Continue the Learning**—that is, assigned work for continued learning outside of the interactive sessions. This work generally consists of two kinds of assignments: reading and (starting in Module 2) doing Video Reflections.

   It's certainly helpful for participants to do reflective tasks outside of interactive sessions, so they actively engage with the ideas in their minds, share what they're trying, and seek help from one another. However, it's also understandable that these tasks may not be feasible for all participants. Some may be hourly paid staff; will they be paid for time spent doing these tasks outside of session hours? Participants likely already have too much work; where and how will time be made for this "extra work?"

   Before deciding on quantity of work beyond the sessions, the facilitation team should confer with participants' supervisors and senior management to determine whether these ongoing reflective tasks will be financially or otherwise supported.

7. Determine your requirements for the Video Reflections, and be ready to communicate them to the community in the next session (if not earlier). Participants will be anxious about the process; being upfront about expectations will help to alleviate their anxiety. Importantly, don't let their apprehension make you doubt the value of video reflections.

Video Reflections are driven by each individual's questions about their own practice, and as such may require participants to record a different video for each reflection. Every module includes at least one session in which participants engage in Video Reflection. There are two formats: first with the whole community, and then in small groups with their critical colleagues.

8. Make sure your room has sufficient space for participants to form two parallel lines for **Thought Swap**. It may be necessary to move into the hallway.

9. Prepare for the Hands-on task, **Cup & Card**. Prepare a tray of the items listed in materials "**For each small group**" of 4–6 participants. (Keep the coins separate; you'll distribute them to each group once it appears they are comfortable with the first part of the challenge.) Try out a few of the materials to make sure the plastic card is stiff enough to hold water when the container is inverted.

10. Review the **Science Explanation for Cup & Card** (see Companion Website) so you are comfortable with the content. Decide whether or not you will copy this optional handout for your participants. Keep in mind that the purpose of this task is not to reach a complete understanding of the physics concepts, but rather to initiate discussions about beliefs and attitudes about learning and what supports learning.

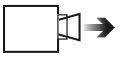
11. Prepare five chart-paper posters for the **Research Discussion**. Title each of the five sheets with a short description of one of the ***Five Foundational Ideas on Learning***:

    - **Learning is an active process.**
    - **Learning builds on prior knowledge.**
    - **Learning that is authentic to the learner is more memorable.**
    - **Learning occurs in a complex social environment.**
    - **Learning requires motivation and cognitive engagement.**

    Small group sizes of 2–6 will work well for this activity. If you have fewer than 10 participants (which means that you can't start off a group of two at each poster), it's fine to have some of the posters unoccupied at any given time. Eventually, each group will be able to discuss and record at each of the posters. A smaller group just means that fewer participants will comment on any one poster.

Preparation for specific **Tasks** (e.g., Hands-on) and **Routines** (e.g., Thought Swap) are provided. Referencing corresponding details in the Step by Step will also be helpful as you plan.

Session 1 Step by Step



Introduction (Part 1)
Goals and Objectives of Reflecting on Practice

1. **Introduce goals and objectives of the program.**
   Display the program objectives and share the following:

   a. *Reflecting on Practice* is a modular program designed for adoption by informal science learning environments so that all educators in the organization can participate and learn together.

   b. The goal of the program is to advance the informal science education field by cultivating communities of learners among its professionals.

   c. The program has three primary objectives:

   - To build shared language and understanding among professionals by relating research to practice.
   - To engage practitioners in habits of reflection, including observing their own teaching, as a means to develop their practice and make it public.
   - To nurture a tradition of continued professional learning among participants, and thereby build a **professional learning community**.

   d. Emphasize that this program is **not** a blueprint for how to teach. Participants bring a wealth of pedagogical knowledge and experience to the program. *Reflecting on Practice* is an opportunity for practitioners with all levels of experience to learn from one another, develop a shared language on educational practice, deepen their knowledge on the science of learning, and exchange ideas on how they teach.

2. **Distribute and introduce Learning Journals**.
   Let participants know:

   a. **Learning Journals** are for their private use, to record in as they go through the program.

   b. The journals should be used to record their thoughts as they reflect on and learn about their own practice. Anything and everything can be entered in the journal. Use words, sketches, diagrams, etc. to express ideas. Encourage them to date their entries so they can see how their thinking changes over time.

A **professional learning community** is a group of practitioners who share and critically examine their practice in a way that is ongoing, reflective, collaborative, inclusive, learning-oriented, and growth-promoting.

c. There will be opportunities to reflect and write during interactive sessions (e.g., "Quick Writes," "Minute Paper") as well as outside of the sessions.

Thought Swap: *Getting to Know Each Other*

The bar below denotes the Task (Retrieve & Connect), Thinking Routine (Thought Swap), and unique title and estimated time for this experience.

25 minutes  Retrieve & Connect

1. A community builder first.
Tell participants before they proceed further, they will spend a few minutes bringing their minds into this session and getting to know one another.

2. Form two lines.
Ask participants to form two lines facing one another, making sure each person in one line has a partner in the facing line. An easy way to ensure this is to have people across from each other make eye contact. Everyone needs a partner; if there is an odd number, someone from the facilitation team should join the line.

3. Introduce the format.
Tell participants how the **Thought Swap** works:

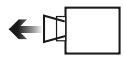
- **a.** There is a set of questions for participants to discuss.
- **b.** You (the facilitator) will ask one question at a time.
- **c.** Participants will have 2–3 minutes to discuss their responses for each question with their partners.
- **d.** When time is up, you will initiate the "touch of silence" down the two lines until the whole group is quiet and ready for the next question.

4. Display the first question:
What do you like about teaching science in your organization?

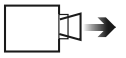
As participants discuss the question with their partners, discreetly walk up and down the lines to get an overview of what partners are discussing.

- **Listen to the noise.** Give participants 2–3 minutes to talk. If after 3 minutes the noise level is still fairly high, they may need an additional minute or two to talk. If the noise level drops (indicating that most discussion has stopped), initiate the "touch of silence" before the discussions spontaneously start up again.
- **Ask for volunteers.** Depending on available time and size of community, encourage 2–4 volunteers to share what they discussed with their partner. Participants can share their own thoughts, what their partner shared, or what they talked about together.

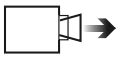
Thought Swap is a whole-group discussion routine to accustom participants to sharing their ideas, first with a partner and then with the whole group. It's the first of many different **Thinking Routines** that will be used throughout the *Reflecting on Practice* program. The routines are designed to help make learners' thinking recognizable and visible to themselves and others. Thinking Routines are introduced in Module 4; details for how to use each one are located on the Companion Website.

Touch of silence: Facilitator touches the shoulder of the first person in  each line. Those individuals stop talking and touch the shoulders of the persons next to them, who also stop talking and touch the shoulders of the persons next to them...and so on down the two lines.

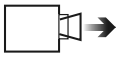
- **Create new partners.** Ask the person closest to you from *one line* to move to the other end of that line, and have everyone from that line move up one space. This establishes new sets of partners for the next question.



5. **Display the second question and repeat Thought Swap routine from #4 above:**
   What do you want your learners to remember from their experiences at your organization?



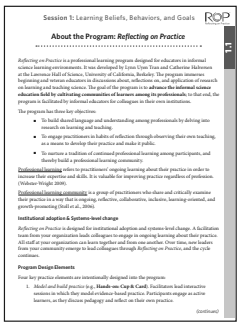
6. **Display the third question and repeat Thought Swap:**
   Recall an occasion when you thought you were at your best, teaching—or saw someone else teaching in a way that excited or inspired you. What was especially effective about it?



7. **Display the fourth question and repeat Thought Swap:**
   What are you wondering or concerned about regarding this program?

8. **Return to seats.**
   Thank everyone for sharing and ask them to return to their seats.

Introduction (Part 2)
The Program and Session 1



Session 1: Learning Beliefs, Behaviors, and Goals ROP

About the Program: *Reflecting on Practice*

Reflecting on Practice is a professional learning program designed for educators in informal science learning environments. It was developed by Lynn Uyen Tran and Catherine Halvorsen at the Lawrence Hall of Science, University of California, Berkeley. The program immerses beginning and veteran educators in discussions about, reflections on, and application of research on learning and teaching science. The goal of the program is to **advance the informal science education field by cultivating communities of learners among its professionals**; to that end, the program is facilitated by informal educators for colleagues in their own institutions.

The program has three key objectives:

- To build shared language and understanding among professionals by delving into research on learning and teaching.
- To engage practitioners in habits of reflection through observing their own teaching, as a means to develop their practice and make it public.
- To nurture a tradition of continued professional learning among participants, and thereby build a professional learning community.

Professional learning refers to practitioners' ongoing learning about their practice in order to increase their expertise and skills. It is valuable for improving practice regardless of profession. (Webster-Wright 2009).

Professional learning communities is a group of practitioners who share and critically examine their practice in a way that is ongoing, reflective, collaborative, inclusive, learning-oriented, and growth-promoting (Stoll et al., 2006).

Institutional adoption & Systems-level change

Reflecting on Practice is designed for institutional adoption and systems-level change. A facilitation team from your organization leads colleagues to engage in ongoing learning about their practice. All staff at your organization can learn together and from one another. Over time, new leaders from your community emerge to lead colleagues through *Reflecting on Practice*, and the cycle continues.

Program Design Elements

Four key practice elements are intentionally designed into the program:

1. *Model and build practice* (e.g., **Hands-on: Cup & Cord**). Facilitators lead interactive sessions in which they model evidence-based practice. Participants engage as active learners, as they discuss pedagogy and reflect on their own practice.

(continues)

1. **Introduce modular design and the big ideas of *Reflecting on Practice*.**
   Distribute the **About the Program: *Reflecting on Practice*** handout and give participants a few minutes to read.

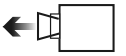
2. **Discuss handout.**
   Once most participants have had a chance to review the handout, invite questions, comments, and concerns for discussion. Some concerns expressed may include:

   - time it will take to participate and do the tasks on top of busy work schedules;
   - the logistics of making—and anxiety about sharing—videos of their teaching;
   - how this program is related to current/changing conditions at the institution;
   - how participation can/will affect job security and performance evaluations; and
   - value and purpose of the program for them, for the department, and for the institution.

3. **Emphasize learning opportunity and professional recognition.**
   Let participants know the extent to which senior management supports and values their participation. Tell participants that this program is an opportunity for learning about their own practice for professional growth. For those who are interested, there is also opportunity for acquiring professional recognition after completion of this program. Let them know the following:

   Reflecting on Practice is a Learning Partner with the **Association of Zoos and Aquariums (AZA)**; an approved continuing education provider for the **National Association for Interpretation (NAI)**; and a special partner with the **Association of Science—Technology Centers (ASTC)**. Participants will receive a Certificate of Completion at the end of the program. They can submit a copy of the certificate to the respective associations to earn appropriate credit.

4. **Display and introduce objectives of Module 1 Session 1** and invite questions for clarification.



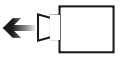
   - Identify your beliefs on learning, behaviors in learning, and goals for learning.
   - Discuss the complexity of learning, and how this complexity is relevant to learning and teaching science in informal environments.
   - Determine personal goals and agendas for participating in this professional learning program.

3-2-1 Bridge: *Ideas on Learning*

5 minutes  Retrieve & Connect

1. **Introduce 3-2-1 Bridge.**
   Have participants take out their **Learning Journals**. Describe that in this routine they will be given a prompt and asked to record their thoughts about it in three phases. Ask them not to overthink their responses! This is an opportunity to freely brainstorm their initial thoughts.
2. **Display prompt:**
   How do people learn?
3. **Ask participants to "record 3 words."**
   Have them quickly write three words that come to mind when they think about how people learn.

3-2-1 Bridge is a Thinking Routine that invites learners to uncover their initial thoughts, ideas, questions, and understandings about a topic, and then, after engaging in learning experiences and receiving some instruction, to connect these to new

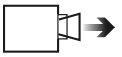


thinking and ideas. The other side of the bridge will occur in Module 4 Session 1 (or sooner if you prefer).

4. **Have them "ask 2 questions."**
   Now ask participants to write two questions they wonder about when thinking about how people learn.

This response may take a little more time for participants to complete than the first two.

5. **Ask them to "develop an analogy or metaphor."**
   Display the definitions and have participants write one analogy or metaphor that encapsulates their ideas about how people learn. (These definitions are adapted from literarydevices.net.)



An **analogy** is a comparison in which an idea or a thing is compared to another thing that is quite different from it. It "explains" that idea or thing by comparing it to something that is familiar.

Example: How a doctor diagnoses diseases is like how a detective investigates crimes.

Metaphor is a figure of speech that makes an implicit, implied, or hidden comparison between two things that are unrelated but share some common characteristics. In other words, a resemblance between two contradictory or different objects is made based on one or more common characteristics.

Example: It's going to be clear skies from now on. (This implies that clear skies aren't a threat and life is going to be without hardships.)

6. **Conclude 3-2-1 Bridge routine.**
   Let participants know they will return to these ideas about learning later in the session and throughout the program. Before they put away their journals, remind them to date and title the entry "3-2-1 Bridge: Ideas on Learning," so they can easily find this entry later. Have them put their Learning Journals away for now.

Retrieve & Connect **10** minutes

Turn & Talk: *Learning Beliefs & Behaviors*

The **Turn & Talk** routine gives learners the chance to express their thinking immediately to someone because the topic, previous task, or novel situation sparked reactions and memories that learners want to share.

1. **Introduce Turn & Talk routine.**
   Tell participants they will now have the opportunity to share their beliefs and assumptions about learning as they "turn & talk" to someone next to them.

2. **Display questions for Turn & Talk discussion**:
   - **a.** *What are the observable characteristics (signs) that learning is happening?*
   - **b.** *What are the conditions that encourage and support learning?*

3. **Initiate "Turn & Talk."**
   Tell participants to turn to someone next to them and talk about the two questions. Remind participants to make sure both people have the opportunity to share their ideas over the next 5 minutes.

4. **Begin whole-group share.**
   Pay attention to the noise. When noise level drops, partner talk is mostly done. After 5–7 minutes of partner talk, call "time" and invite participants to continue talking in the whole group. Say that they can respond to one question at a time, or to a combination or synthesis of both questions. Facilitate the discussion using the following steps:

   - Invite and listen to their responses. Record ideas on the board as you facilitate the discussion.
   - Encourage participants to elaborate on their thinking by providing explanations, evidence, or clarifications.

     Suggested probing questions:
     - What makes you think that?
     - Please give an example from your experience.
     - What do you mean?
   - Wait sufficiently long for participants (especially the quieter ones) to share ideas, and stay neutral in your reaction to all comments.
   - Draw others into the conversation by asking them to think more deeply about what is being shared.

     Suggested probing questions:
     - Can anyone add something to that comment?
     - How can we consider that idea from another vantage point?

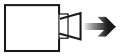
5. **Transition to Activity.**
   When no more new ideas are being shared, direct participants' attention to the board where their ideas were recorded. Tell them to keep these ideas in mind during the next task.

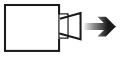
   The group will have generated many ideas on the board about how to tell if someone is learning and how to support learning. Refer to this list of ideas later, during the **From Learners' Perspective** task following the **Cup & Card** activity.

Facilitating whole-group share.
It takes practice and patience to facilitate whole-group discussions that are substantive and inclusive. The following steps and suggested probing questions provide guidance as you practice. It is important to be non-judgmental in your responses. Keep a "poker face," and refrain from saying "right!" to the response you were expecting and hoping to hear. Your neutrality encourages participants to contribute their viewpoints, which is critical for constructing meaning together. Take your time, be sure to pause after questions and comments, and encourage participants to listen attentively and consider the ideas being shared.

Hands-on **20** minutes

The hands-on activities in this program are designed to be engaging and challenging science learning experiences for adults. As such, participants can engage fully and authentically as learners. Tasks after the activity invite participants to consider the experience *from the learners' perspective* and use those insights to transfer the ideas on learning *into their practice*.





This activity is designed to spark conversation on learning beliefs, behaviors, and goals. As designed, it doesn't fully explore the physics concepts for complete understanding. Some participants are just fine with this, while others may feel dissatisfied. These various reactions foster an interesting discussion about whether learning was taking place, and if so, what was learned.

Cup & Card

1. **Introduce the concept of being a learner.**
   Tell participants that the hands-on activities in the *Reflecting on Practice* program are designed to place them in the role of the learner. Display and share the following information:
   - **a.** The hands-on activities provide a shared experience for participants to think about learning and teaching.
   - **b.** These hands-on activities are designed for participants to be in the role of the learner. The activities reflect the types of hands-on experiences they lead for their learners, so encourage them to take advantage of the opportunity to engage fully as a learner.
   - **c.** If they have done the activity before, or have a deep understanding of the concept, remind them to give space for their colleagues to mess with the ideas. They can also go deeper in their own understanding of the concept, and bring their colleagues along with them.
   - **d.** Activities used in this program are not designed to be used "as is" with visitors to informal science learning environments. If interested, participants can design an appropriate variation of the activity to be used with visitors.
2. **Advise them to pay attention to the learning experience.**
   Tell participants they will be given a challenge to explore a physics concept with their colleagues in small groups. As they participate, they should also pay attention to what is being learned, and how.
3. **Display the instructions and challenge questions** and **demonstrate the steps** without actually doing the activity.

Cup & Card Instructions

Fill containers with water from the pan and place a plastic card over the top. Invert each container and observe what happens.

Challenge questions:

1. Can you get the card to stay on the inverted "cup?"
2. Does the amount of water matter?
3. How does the shape of the "cup" affect the results?

4. **Encourage exploration.**
   Encourage participants to explore using different amounts of water and differently shaped cups/containers. Ask them to learn all they can about the combination of cups, water, and card. Let them know they will have 15 minutes to investigate.

5. **Start the Activity.**
   Distribute the materials to each small group and have them work, explore, and discuss what they discover in their small group.

6. **Encourage discussion.**
   Circulating around the room, prompt group members to discuss their ideas, discoveries, and questions with each other. Suggested prompts:

   - Does it matter how much water is in the cup?
   - How does the shape of the container affect the results?
   - What generalizations can you make?
   - The other group made this observation. How does your experience compare?

7. **Introduce the Coin Challenge.**
   After participants have had an opportunity (~10 minutes) to explore various combinations of cups, water, and cards, distribute about 50 coins to each group. Do the following:

   a. Challenge each group to count how many coins can be added to a cup with water before the card falls off when the cup is inverted. What do you notice?

   b. Circulate around the room and ask some of the following guiding questions:

   - How many coins can you add? Who can add the most coins?
   - Is there a relationship between the containers' size/shape, amount of water, and number of coins each will hold?
   - Do you find anything puzzling about your discoveries?
   - What does and does not make sense to you?

8. **Wrap up the activity and clean up materials**.
   Have each group place all materials back on the tray and move the tray and pan to the side or back of the room.

From Learner's Perspective **10** minutes

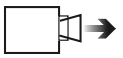


Table Talk: *What Did You Learn?*

1. **Display prompts and discuss in small groups**.
   Ask participants to think about the questions silently for a moment to collect their thoughts about the learning experience that just occurred.

   When they're ready, have them talk in their small groups and address the following questions about the **Cup & Card** activity:

   a. *What did you learn?*

   b. *How did you learn it?*

   c. *When did the learning occur?*

   d. *How did you know you were learning?*

2. **Begin whole-group share.**
   Encourage participants to share what they discussed in the small groups. Facilitate the discussion using the following steps:

   a. Invite and listen to their responses. Record ideas on the board as you facilitate the discussion.

   b. Encourage participants to elaborate on their thinking by providing explanations, evidence, or clarifications.

   Suggested probing questions:
   - What makes you think that?
   - Please give an example from your experience.
   - What do you mean?

   c. Draw others into the conversation by asking them to listen closely to what is shared.

   Suggested probing questions:
   - If that were the case, what assumptions are we making?
   - What's another way to phrase that comment/idea?
   - Can anyone add something to that comment?
   - What's another perspective on this idea?

   d. (Optional) Distribute the handout **Science Explanation for Cup & Card**.

3. **Connect back to ideas about learning.**
   Direct participants' attention to the previously discussed and recorded ideas about how to tell if someone is learning and how

Some participants will initially focus on explaining the scientific phenomenon, while others will dwell on the playfulness of the experience. Both elements are part of the activity, though neither are explored fully in the way the activity is designed for this session. Push on participants to think about and articulate their thinking process in the learning experience to consider what they learned and how they learned it.

Wait for participants to be ready to talk, especially the quieter ones, and stay neutral in your reaction to participants' comments.

to support learning. Encourage participants to make connections between ideas shared in the **Retrieve & Connect** discussion and their experiences during the **Cup & Card** activity.

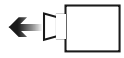
Walkabout: *Five Foundational Ideas on Learning*

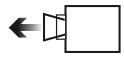
55 minutes Research Discussion

(A) Learning Styles (10 minutes)

1. **Hang the five chart papers for the *Five Foundational Ideas on Learning*** around the room. (If wall space is limited, the charts can be placed on five different tables.)
2. **Initiate a collective recall of video on learning styles.** Remind participants they were asked to watch a TEDx video on learning styles prior to this first session.
   - **a.** Acknowledge that not everyone might have watched the video, and those who did watch might have questions and reactions.
   - **b.** Display the prompt, "*What did the presenter talk about?*" to do a collective recall to remind everyone what the video was about, not their reactions to the content. They will get the chance to share their questions and responses afterwards.
   - **c.** Allow participants to just call out what they remember, e.g., a woman gave a TED talk, she said learning styles are not real, she explained . . .
3. **Display the learning styles argument.** Following the collective recall, articulate the general argument for learning styles that Marshik explained had little to no evidence to support:
   - Learning styles refer to people having different preferences for
     - processing certain types of information (e.g., visual, auditory, kinesthetic), and
     - processing information in certain ways (e.g., intuitive or analytical thinker).
   - Learning styles theories argue that
     - learners have different learning styles (or preferences), and
     - their learning could be improved by matching our teaching with learners' preferred learning styles.
   - Studies in support of learning styles would need to provide evidence that there are greater learning gains if instruction aligned with the learner's learning style.

A collective recall is not a summary. If asking for a "summary," one or two people (likely the usual outspoken individuals) will give their take on what was presented. Participants with uncertainties or who didn't understand might be reluctant to speak. A collective recall asks everyone to contribute to piecing together the information and thus more individuals are retrieving their memories.





Pace yourself. Be sure to have at least 40 minutes for the Walkabout.

This conversation on learning styles is extremely brief, and your community will likely need/want more time. It's inserted here to address the idea upfront before proceeding further into conversations on how people learn. Otherwise, people who believe in learning styles will work to make it fit within the conversations to come. This acknowledgement at the beginning is intended to ease their embarrassment of supporting a popular idea publicly that has little or no evidence supporting it.

Participants who believe strongly in learning styles may have a really hard time with this conversation. They are experiencing cognitive dissonance. Give them space to process. Acknowledge to everyone that belief in learning styles is pervasive. There will be many opportunities throughout this program to revisit their beliefs, with readings, experiences, and discussion on learning. Reassure everyone that this is not the only conversation.

4. **Display and point out how those learning styles arguments are flawed, as presented by Marshik.**
   - There is little to no empirical evidence to support these learning styles theories.
   - Learning is the same regardless of how the content is presented to you.
   - Most of what we learn is stored in terms of meaning.
   - The best way to learn (or teach) something depends on the content itself (e.g., listening to bird songs to learn how to identify birds by their vocals).
   - Many things can be taught and learned using multiple senses.
5. **Brief discussion.**
   Invite participants to share their thoughts and questions from Marshik's talk.
   a. Invite and listen to their responses.
   b. Encourage participants to elaborate on their thinking by providing explanations, evidence, or clarifications.
   Suggested probing questions:
   - What makes you think that?
   - Please give an example from your experience.
   - What do you mean?

   c. Draw others into the conversation by asking them to listen closely to what is shared. Suggested probing questions:
   - Let's build on that idea.
   - If that were the case, what assumptions are we making?
   - Can we consider that idea from a different vantage point?
6. **Points to address if they don't emerge from the conversation.**
   - Recognizing and valuing individual differences in our learners is necessary, but this recognition doesn't translate into teaching according to learning styles.
   - Humans are multi-sensory organisms. Educators should provide learners with multiple experiences involving various modalities.
   - People may have preferences for learning in particular ways. The more often they favor those preferences, the more comfortable those ways become for them.

7. **Pose the rhetorical question to segue into the research discussion.**

   If learning styles don't exist, then how should we think about how people learn and how to teach in support of learning?

(B) Introduction and Directions (5 minutes)

1. **Introduce Research Discussion.**
   Explain to participants that their personal and professional experiences are valuable sources of knowledge for understanding learning and teaching. This knowledge, may be limited to what they've experienced personally. Share the following information.

   - Research Discussions give participants a chance to relate their experiences and thinking to ideas reported in "the literature."
   - "The literature" comprises published information, such as empirical studies, reviews, meta-analyses of studies, and theoretical papers. Ideas from these publications are synthesized into texts written for this program.
   - Participants are challenged to consider how ideas from the literature might be used to inform their practice. They are encouraged to agree or disagree with the ideas, extend the ideas into new and different directions, and want more details, perspectives, etc.
   - These reactions show they are thinking deeply about the ideas and are trying to reconcile them with their own understanding and experiences.

2. **Introduce Walkabout Routine.**
   Tell participants that throughout the *Reflecting on Practice* program they will have the opportunity to engage in research discussions in various ways. Describe the steps of this routine as follows:

   a. Five chart papers for the *Five Foundational Ideas on Learning* have been placed around the room. Each chart paper has one of the foundational ideas listed. More details about the idea are in the handout they will receive.

   b. They will work in small groups to consider and discuss each idea and record their conversation on the chart. They will have about 5 minutes for each idea.

   c. Each group will have a different-colored marker so that, as conversations are recorded from chart to chart, groups can compare their responses. Each group can decide whether everyone will take turns writing or if someone will be designated as a recorder.

Some participants may be familiar with the literature and concepts in these readings. Acknowledge their knowledge and invite them to continue to learn. Similar to the science content in the hands-on activities, if they have deep understanding of the concepts, remind them to give space for their colleagues to mess with the ideas. They can also go deeper with their own understanding, and bring their colleagues along with them.

The **Walkabout** is a Thinking Routine for learners to have progressively deeper conversations as they move from one topic to the next. While they move to a new idea every 4-7 minutes, the ideas are interconnected so, collectively, they will have discussed the main idea for a longer time.