Addressing the Measurement Gap: *Embedded Assessment Strategies to Understand Citizen Science Volunteers' Skills*

Why Assess Citizen Science Volunteers' Skills?[1,2]

Science inquiry is inherent to citizen science. If volunteers are not competent with targeted science skills, then data may be of low quality and even discarded, volunteers may lose motivation, and education and science goals may not be met. However, few citizen science projects directly assess volunteers' skills.

What are the Benefits of Embedded Assessment?[3,5,6]

Embedded assessments allow learners to demonstrate their competency through authentic tasks that integrate seamlessly into the learning experience (e.g., test presented as a game).

- They are not an added burden for volunteers.
- They can be performance-based activities that mirror real-life problem-solving situtations.
- They can encourage project leaders to reflect on their training of targeted skills.

What are the Challenges in Using Embedded Assessment?[1,4]

- They are not typically used within citizen science.
- They require dedicated time and resources to develop, implement, and score.
- There are limited relevant training and resources.
- It is difficult to create a one-size-fits-all solution given the diversity of citizen science projects.

References

[1]Stylinski, C.D., Peterman K. Phillips, T., Linhart J., & Becker-Klein, R. (2020). Assessing science inquiry skills of citizen science volunteers: A snapshot of the field. International Journal of Science Education, Part B, 10(1), 77-92.

[2]Phillips, T., Porticella, N., Constas, M., & Bonney, R. (2018) A framework for articulating and measuring individual learning outcomes from participation in citizen science. Citizen Science: Theory and Practice, 3(2), 3.

[3]Peterman K., Becker-Klein R., Stylinski C. and Grack Nelson A. (2017). Exploring embedded assessment to document scientific inquiry skills within citizen science. In Pages 63-82. C. Herodotou, M. Sharples, and E. Scanlon (Eds.), Citizen Inquiry: A Fusion of Citizen Science and Inquiry Learning. Routledge, Oxon, OX.

[4]Becker-Klein, R., Peterman, K., & Stylinski, C. (2016). Embedded assessment as an essential method for understanding public engagement in citizen science. Citizen Science: Theory and Practice, 1(1).

[5]Rural School and Community Trust. (2001) Assessing student work. Retrieved at: http://www.ruraledu.org/user_uploads/file/Assessing_Student_Work.pdf.

[6]Wilson, M., & Sloane, K. (2000). From principles to practice: An embedded assessment system. Applied measurement in education, 13(2), 181-208.

Graphics from The Noun Project (Chak Hernández, Gan Kheen Lay)

Approach

Explore two collaborative strategies (A and B) to develop assessments of citizen science volunteer skills that have the characteristics in the below funnel.

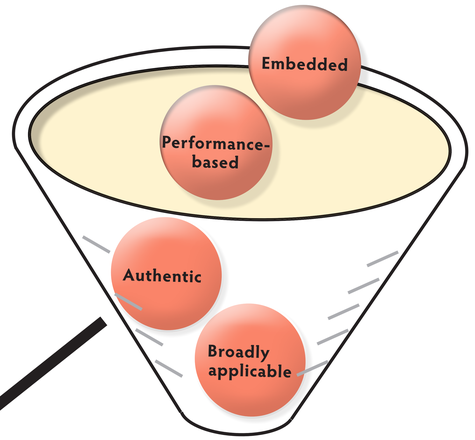
- **Strategy A:** Re-analyze data validation archives and procedures to focus on volunteer skill gains
- **Strategy B:** Create shared embedded-assessment measures for several science inquiry skills

Research Questions

What processess are involved in applying the two embedded assessment strategies?

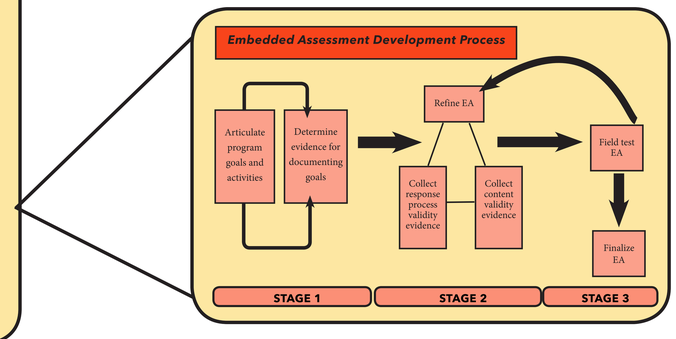
How do projects use the embedded assessment results to inform their programming?

Challenge: Create assessments that are....



Preliminary insights and findings

- Science inquiry skills need to be broken into concrete and clearly defined subskills for assessment. For example, the broad skill "scientific observation" of organisms can be deconstructed into:
  - "Notice relevant features"
  - "Record standard observations"
  - "Estimate high counts"
- Project leaders need time and support to refine broad and uncertain conceptualization of their volunteers' science inquiry skills into subskills.
- Our *Embedded Assessment Development Process* can support creation, testing and refinement of shared measures that can be applied by multiple projects.
- Data validation records may include 'tracers' of volunteers' subskill gains.
- Use of embedded assessments can lead to changes in project leaders'
  - Understanding of volunteers and their skills
  - Attitudes about assessment
  - Future applications of assessment
    - Plans for project programming (e.g., changes to training or protocols)



Streamline EMBEDDED ASSESSMENT

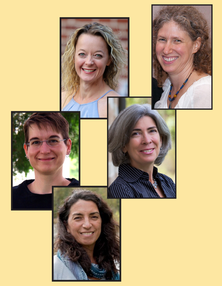
Partners

Leaders
- Rachel Becker-Klein (Two Roads Consulting)
- Veronica DelBianco (U of Maryland Ctr for Environmental Science)
- Karen Peterman (Karen Peterman Consulting, Co.)
- Tina Phillips (Cornell Lab of Ornithology)
- Cat Davis Stylinski (U of Maryland Ctr for Environmental Science)
- Andrea Wiggins (U of Nebraska Omaha)

Consultants and Staff
- Amy Grack Nelson (Science Museum of Minnesota)
- Marshall Illiff (Cornell Lab of Ornithology)
- Jenna Linhart (U of Maryland Ctr for Environmental Science)

Advisors
- Joe Heimlich (lead, COSI Ctr for Research & Evaluation)
- Nicole Ardoin (Stanford U)
- Anne Bowser (Wilson Center)
- Mac Cannady (UC Berkeley)
- Martin Storksdieck (Oregon State U)

Strategy A Project Leaders
- Megan Mueller (Rocky Mountain Pika Project)
- Christy Pattengill-Semmens (REEF)
- Julia Parrish (COAAST)
- Laura Trouille (Gravity Spy)
- Julie Vastine (ALLARM)



Strategy B Project Leaders
- LoriAnne Barnett (Nature's Notebook)
- Kevin Bonine (Biosphere 2 Earth Systems)
- Alison Cawood (Chesapeake Bay Parasite Project)
- Robert Costello (eMammal)
- Sara Fitzsimmons (Chestnut Mega Transect)
- Chris Goforth (Natural North Carolina)
- Emma Greig (Project FeederWatch)
- Shelly Grow (FrogWatch)
- Michael McKelvey (Bee Spotter)
- Jen Meilinger (Michigan Butterfly Network)

This material is based upon work supported by the National Science Foundation (AISL 1713424). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.