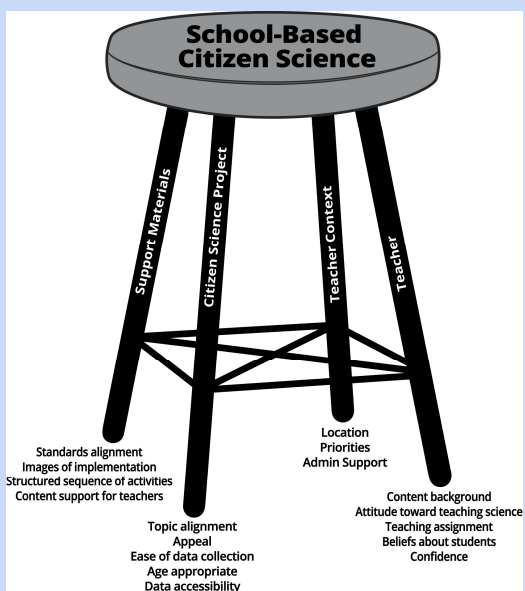




Overview

TL4CS focuses on 5th grade teachers' learning and use of educative support materials when incorporating citizen science (CS) projects into their instruction. Our team has developed educative support materials for two CS projects: Community Collaborative for Rain, Hail, and Snow Network (CoCoRaHS) and the Lost Ladybug Project. Support materials are organized in nine monthly activities for each project, designed for students to make sense of data they and other citizen scientists collected during the month. Front Matter supports (e.g., Considerations for Outdoor Learning) provided guidance across all activities. Activity-Embedded Supports (e.g., accounts of a fictional teacher's enactment) are specific to each month's activity. Study participants used the materials for a full year.

From our work, a theory of school-based citizen science (SBCS) has emerged (Smith et al., 2025). The theory asserts that a teacher's enactment of school-based citizen science is mediated by four factors--the citizen science project itself, the teacher, the teacher's context, and support materials--and the connections between them.



Teacher Learning for Effective School-Based Citizen Science

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Research Questions

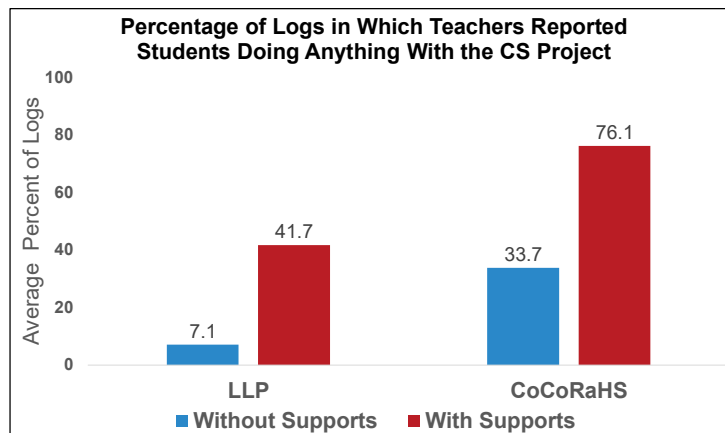
1. Does access to educative supports for a citizen science project influence the extent to which teachers engage their students with the project? If so, how?
2. What types of educative supports do teachers use and value the most?

Research Design

Randomized controlled trial with 52 5th grade teachers randomly assigned to receive educative supports for one CS project or the other (CoCoRaHS or LLP). Teachers were asked to implement both projects and completed a weekly log describing their use of the CS projects and the educative supports.

Findings

1. Educative support materials had a large positive effect on teachers' use of each CS project (Mann-Whitney U test: LLP $z = -6.02$, adjusted $p < .001$; CoCoRaHS $z = -4.05$, adjusted $p < .001$).
2. The effect was larger for LLP ($r = .835$) than for CoCoRaHS ($r = .562$).
3. Teachers were more likely to use CoCoRaHS than Lost Ladybug in both conditions (Wilcoxon Signed Rank test $z = -4.030$, adjusted $p < .001$).



"[We] didn't have any information on Lost Ladybug. All we did was just look once in a while for ladybugs. Is that what I was supposed to do? I don't know because nobody ever tells you what to do. So what are we gonna be looking for? Lost ladybugs? We don't know. We have no idea. . . . I don't recommend doing stuff with no guidance or support. I think guidance [and] support is essential." (CoCoRaHS Teacher)

"Obviously, I've been given material for Lost Ladybug, so it makes it just really easier. I don't have the time to go look up material for CoCoRaHS, so probably during my weather unit, which is going to be in February and March, I will take more time to look at [CoCoRaHS], but right now I'm not because it's not a part of my curriculum." (LLP Teacher)

4. Teachers did not use all kinds of supports equally. They were more likely to use supports embedded within monthly activities than those that applied across activities. Teachers were more likely to use certain types of embedded supports than others, particularly those that explicitly addressed activity implementation.

Implications for School-Based Citizen Science (SBCS)

1. SBCS is a complex endeavor that requires taking into account the teacher, the context, and the unique features of the CS project.
2. Educative support materials can have a large positive effect on how easily and how well teachers take up CS projects in their instruction.
3. Several design principles have emerged from our work that can help CS project organizers create effective support materials. These principles include:
 - a. Design support materials that encourage sustained and purposeful project engagement
 - b. Engage educators in the design
 - c. Prioritize supports that maximize benefits for all involved in the project

TL4CS Publications

- Carrier, S. J., Sachs, L. H., McGowan, J. M., Hayes, M., Smith, P. S., Goforth, C. L., & Safley, S. E. (2024). Elementary teachers as collaborators: Developing educative support materials for citizen science projects. *International Journal of Science Education*, 47(1), 107-127.
- Carrier, S. J., Scharen, D. R., Hayes, M., Smith, P. S., Bruce, A., & Craven, L. (2024). Citizen science in elementary classrooms: A tale of two teachers. *Frontiers in Education*, 9.
- Carrier, S. J., Scharen, D. R., Hayes, M., Smith, P. S., Craven, L., McGowan, J. M., Goforth, C. L., Bruce, A., Safley, S., Sachs, L. (in press). Incorporating participatory science in elementary schools: Teacher and student experiences with outdoor learning. *Electronic Journal for Research in Science & Mathematics Education*.
- McGowan, J. M., Sachs, L. H., Bruce, A., Scharen, D. R., Hayes, M. L., & Smith, P. S. (in press). Citizen Science in the Elementary Classroom: Going beyond data collection. *Science & Children*.
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- Smith, P. S., Goforth, C. L., Carrier, S. J., Hayes, M. L., & Safley, S. E. (2025). An Emerging Theory of School-Based Participatory Science. *Citizen Science: Theory and Practice*, 10(1).
- Smith, P. S., Peterson, E. S., Goforth, C. L., Scharen, D. R., Hayes, M. L., & Carrier, Sarah J. (2025). *Elementary teachers' use of educative support materials for participatory science projects: Affordances, obstacles, and impacts*. [Manuscript submitted for publication]



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