



**RESEARCH + PRACTICE
COLLABORATORY**

Designing Implementation Resources in Research + Practice Partnerships

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R+P Collaboratory



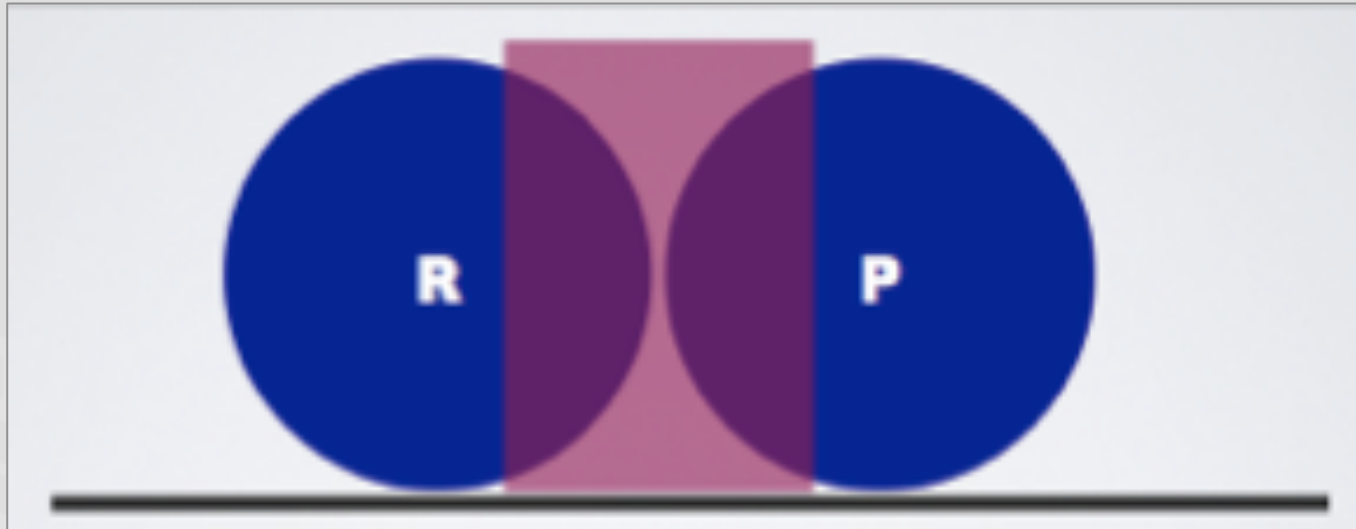
The R + P Collaboratory is an NSF-funded project formed to address the gap between research and practice in STEM education, across both formal and informal settings.



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R+P Theory



We are experimenting with novel arrangements that better connect research and practice as well as build new relationships between researchers and practitioners.



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Levels of Collaboratory Work

LEVELS	EXAMPLES
We are supporting researchers and practitioners to create new forms of research and design partnerships	<ul style="list-style-type: none">- Researchers at CSSS- Workshops at NARST- Webinars
We are designing and testing research practice partnerships in STEM improvement efforts to create new insights and resources for the field.	<ul style="list-style-type: none">- Adaptation site research
We are creating new tools for both researchers and practitioners. These tools and other resources will be available on http://researchandpractice.org	<ul style="list-style-type: none">- Practice Briefs- Curating resources (PD guide)- Website



Collaboratory R+P Partnerships: Focal Areas

STEM PRACTICES

**FORMATIVE
ASSESSMENT**

**INTERACTIVE
TECHNOLOGIES**

**LEARNING ACROSS
SETTINGS**



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Creating New Tools

STEM PRACTICES



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Practice Briefs

STEM Teaching Tool #47

Practice Brief

Is it important to distinguish between the explanation and argumentation practices in the classroom?






What Is The Issue

The [Next Gen Science Standards \(NGSS\)](#) expect learners to engage in the science practice of 'constructing explanations' and also in 'argument from evidence' (along with six other practices). But, some curricula and PD resources don't make this distinction. They integrate argumentation into explanation and say that it isn't important for students to understand the difference. Does it matter?

Authored by [Philip Bell](#) and [Andrew Shouse](#); Jan 2014, orig Nov 2013.

Why it Matters to You

-  **Teachers** should help students understand how scientific knowledge is produced through explanation and argumentation.
-  **District staff and PD providers** should emphasize the distinction between explanation and argumentation in PD.
-  **School leaders** should learn to recognize what it looks like for student to learn science through argumentation and explanation focused talk and writing.

Things To Consider

- **Explanations** are constructed from models and representations of reality—not out of data and warrants. With **arguments**, scientists attempt to logically reason from the data to a conclusion using appropriate warrants. Argumentation often involves comparing different explanations for natural phenomena in an evidence-based way. The two practices are deeply linked to each other, but they do different intellectual work for scientists. [Review the Model of Scientific Practices](#) to learn more.
- It can be simpler to not distinguish explanation from argumentation—to introduce students to one practice rather than two. This comes with some downsides.
- Argumentation involves a level of uncertainty—one argues to clarify for herself or to persuade others who have a different idea. A measure of uncertainty is powerful for constructing open-ended, authentic investigations for a class. Focusing on explanation and ignoring argumentation may inhibit such investigations. If this intellectual work is only framed for students as explanation then the classroom process of exploring and testing different student ideas through evidence-based argument may not happen. Explanation can easily only focus on finding the "right answer"—rather than understanding the conceptual ideas.
- Science curricula and assessments will likely differentiate between the two practices since the NGSS did, so learners need to see them as separate aspects of doing science.

Attending to Equity

- All students should be fully engaged in argumentation- and explanation-focused instruction. [Science communication is cultural](#) and needs to be taken into account. Students with limited proficiency in English often [benefit from more custom supports](#) in order to fully participate.

Recommended Actions You Can Take

- [Learn more about the explanation and argumentation practices](#) from the [Framework for K-12 Science Education](#).
- Distinguish between explanation and argumentation in lessons and show how they connect. Use [different rubrics](#) to analyze student work and thinking for each practice.
- [Read a summary of the background research](#) article by Osborne & Patterson on the differences between explanation and argument in science.

QR Code for Related Resources



"Whereas the goal of scientific explanation is to provide a causal account of events in the material world, argument seeks to use data and warrants to justify belief."

— Stephen Toulmin, philosopher



[Model for Scientific Practices](#) (from [NRC Framework for K-12 Science Education](#))

Things to Think About

- Where does the explanation or argumentation practice already show up in your teaching—perhaps persuasive writing or debate? Do they?
- What might be confusing to students as you help them understand the difference between argumentation and explanation?
- How does the difference between argumentation and explanation show up in other subjects (e.g., history, language arts)?

Also See STEM Teaching Tools:
[7 - The Explanation Practice](#)
[12 - The Argumentation Practice](#)
[48 - Explanation-Argumentation T-Chart for Students](#)



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Other Practice Briefs in Progress

1. Why should students investigate contemporary science topics in your classroom?
2. Practices should not stand alone
3. How Multiple Instructional Models Can Support Practices
4. How can curriculum adaptation be a strategy for helping teachers learn about NGSS?
5. Using productive talk strategies
6. How design provides an entry point for learning STEM and the Arts while expanding what counts as “engineering”
7. What do we mean when we talk about modeling?
8. Where to start with PD?



Rationale for Practice Briefs

- Create a curated collection of bite-size ‘practice briefs’ around problems of practice and viable approaches—akin to policy- and research-briefs
- Put ‘practice briefs’ into thematic categories related to various dimensions of implementation
- Create these collections around the R+P themes—at least practice-focused instruction to explore the approach



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Research Briefs

<http://relatingresearchtopractice.org>

Relating Research to Practice in Informal Learning Environments

Research Brief

by Bronwyn Bevan

Supporting scientific practices through
opportunities to design and reflect



Researchers found that students developed greater levels of what they call scientific abilities when provided opportunities to design, refine, and reflect on science experiments during a laboratory course, as compared with students who conducted more traditional labs which involved following directions in already established experimental designs. Scientific abilities include attention to measurement issues, surfacing and discussing assumptions in mathematical procedures, evaluating data, and communicating results. In other documents these scientific abilities might be called inquiry process skills (Roth, 1994) or scientific practices (BB2)(NRC, 2010). This article will be of interest to informal educators who seek to provide students with opportunities to create, make, invent, and lead their own scientific investigations.

In a controlled experiment, college students who participated in traditional labs where they followed directions to implement experiments to answer problems spent most of their lab time engaged in discussions about logistical matters (such as mathematical procedures). In contrast, another set of students was scaffolded (BB3)(e.g., given a self-assessment rubric that focused their attention on different aspects of scientific reasoning) to design and reflect on the design of their own experiments to answer problems. This second group of students spent most of their lab time in sense-making discussions, such as uncovering assumptions or uncertainties. The authors note that designing their own experiments required students to "activate their prior knowledge, differentiate their ideas, and look at lab tasks with scientific eyes" (p. 91).

The authors conjecture that one reason for the difference in the amount and nature of the time "design" versus "non-design" students spent in the lab might be that students who designed their own experiments were unsure of their actions, which created the conditions for metacognitive thinking, such as planning and evaluating both experimental methods and results. Moreover, the authors note that the prescriptive aspects of the traditional lab may have reinforced students' habits of not spending time on monitoring and reflecting.

The study finds that students who designed their experiments demonstrated better scientific abilities than the "non-design" students, although the students performed equally well on the paper-and-pencil tests given as midterm and final exams. The authors believe that this is because paper-and-pencil tests do not measure scientific ability but rather recall of scientific facts. The authors therefore conclude that students who engage in designing experiments "learn more" than those who do not.



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Other Research Briefs Available

1. Supporting students in constructing scientific arguments
2. Professional development through school-based communities of practice
3. Visual and spatial thinking in science
4. Questioning strategies to deepen scientific thinking
5. Re-thinking learning in science
6. Developing communities of practice for middle school math teachers
7. Supporting scientific practices through opportunities to design and reflect



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Building Research-Rich Resources

1. Think about your particular work and a specific task within that work
 - Example: NGSS adoption process
 - Implementing PD related to the vision of the *Framework*
2. Identify leverage points within this task
 - How do you expand opportunities to participate in PD at all levels of the system?
 - How do you encourage and support local level adoption of NGSS when the state is not supporting adoption?
 - How do use research to inform and coordinate Professional Development?



Small Group Discussion

1. What practice brief topics combining perspectives from research and practice would be most useful?
2. How might Practice Briefs be improved to suit your needs?



Reflection

- Do practice briefs seem like a good idea?
- Which briefs should be prioritized?
- How can the efforts of the Collaboratory aid your existing implementation activities?
- What expertise might the CSSS contribute to the creation or dissemination of practice briefs?



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Conclusion

- How else can the Collaboratory engage with the CSSS community?
- This material is based upon work supported by the National Science Foundation under Grant No. (grantee must enter NSF grant number). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
- <http://researchandpractice.org>



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