Leveraging Professional Development to Design and Enact NGSS-aligned Materials in Uncertain Policy Contexts

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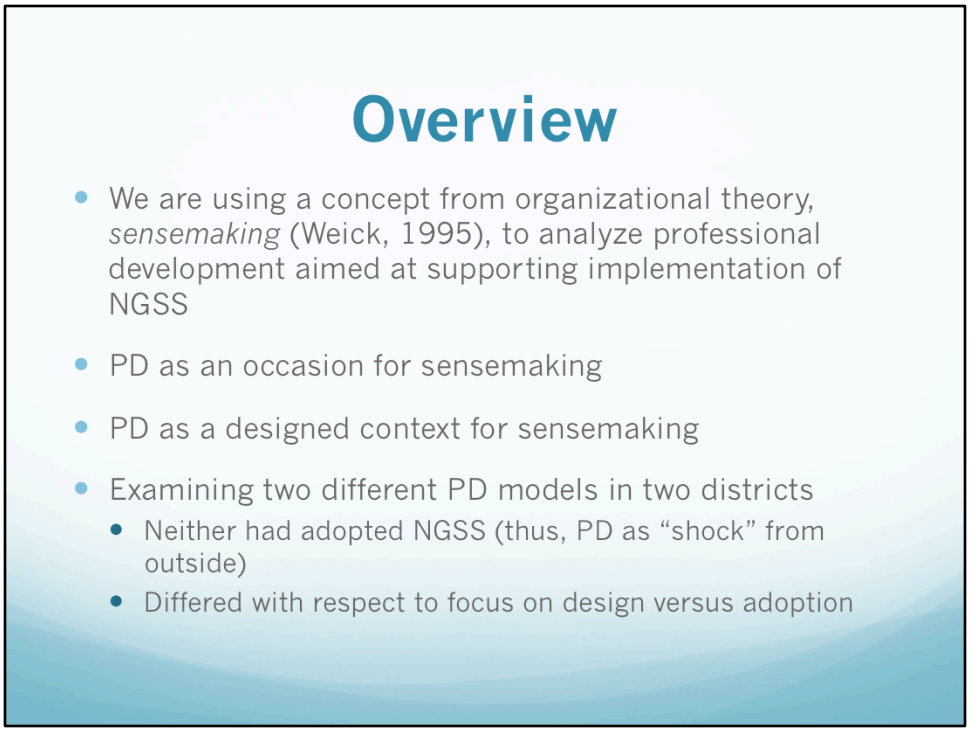
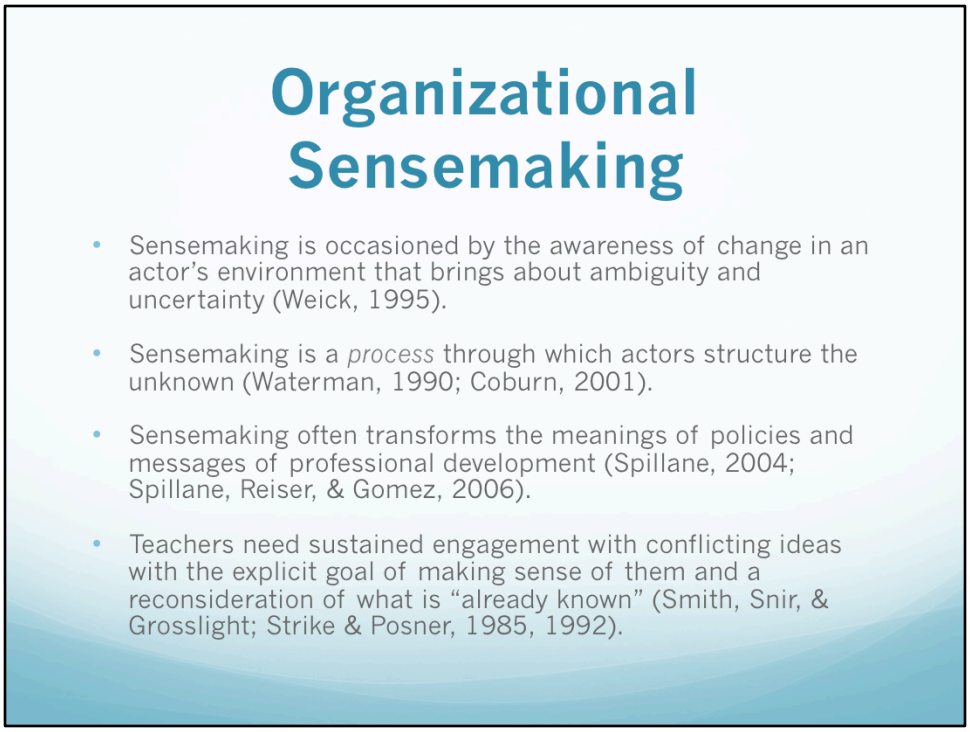
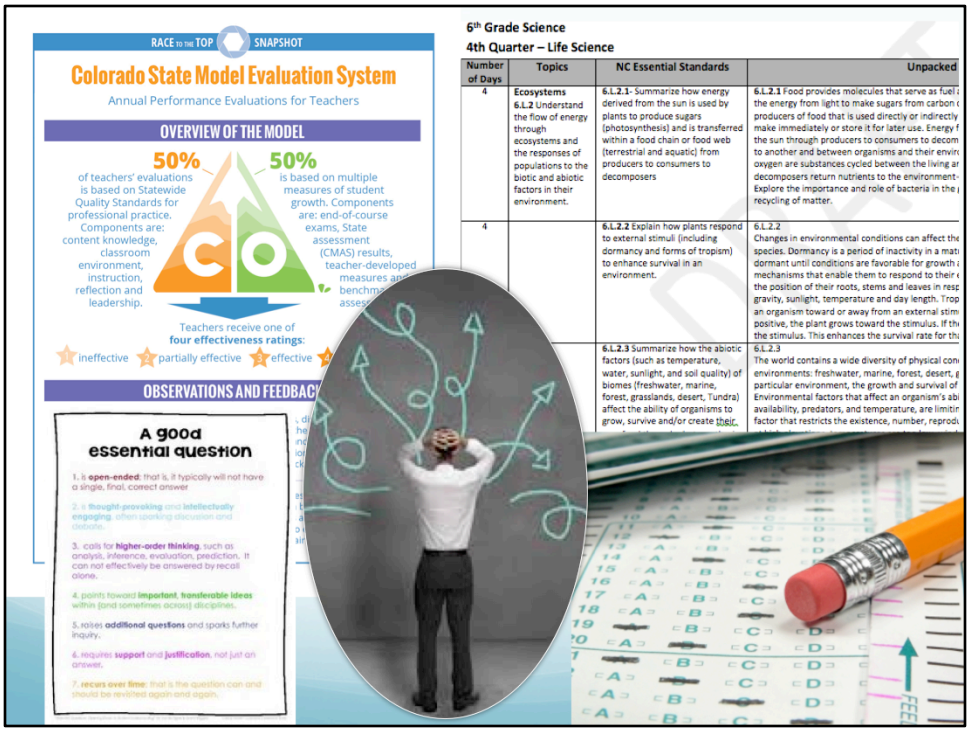


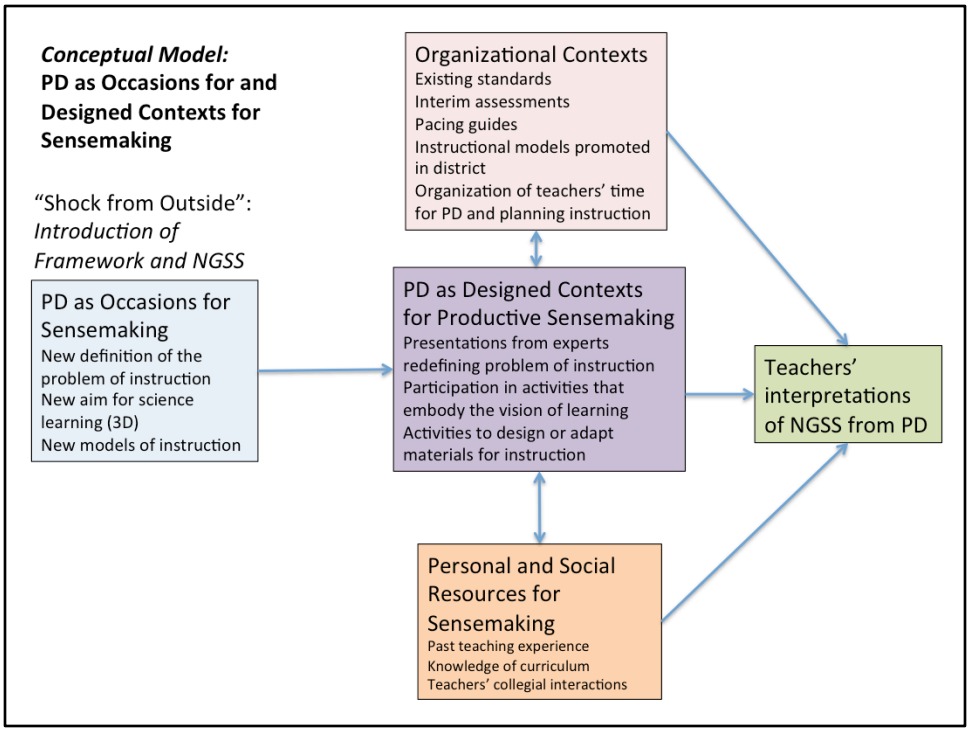
A quick overview: We'll be talking about two distinct PD models that introduced teachers to the Next Generation Science Standards. Using a lens from organizational theories called sensemaking, we view these PD contexts as spaces that occasion teacher sensemaking. I'll first present the our study design and the findings from our first case. Sam then will present the second case and our conclusions.



We usually talk about "sensemaking" in science education as the activity when students are thinking about and talking about a science idea or investigation. We are using this term in the way that organizational theorist Karl Weick does – as sensemaking about shifts in an actor's environment.

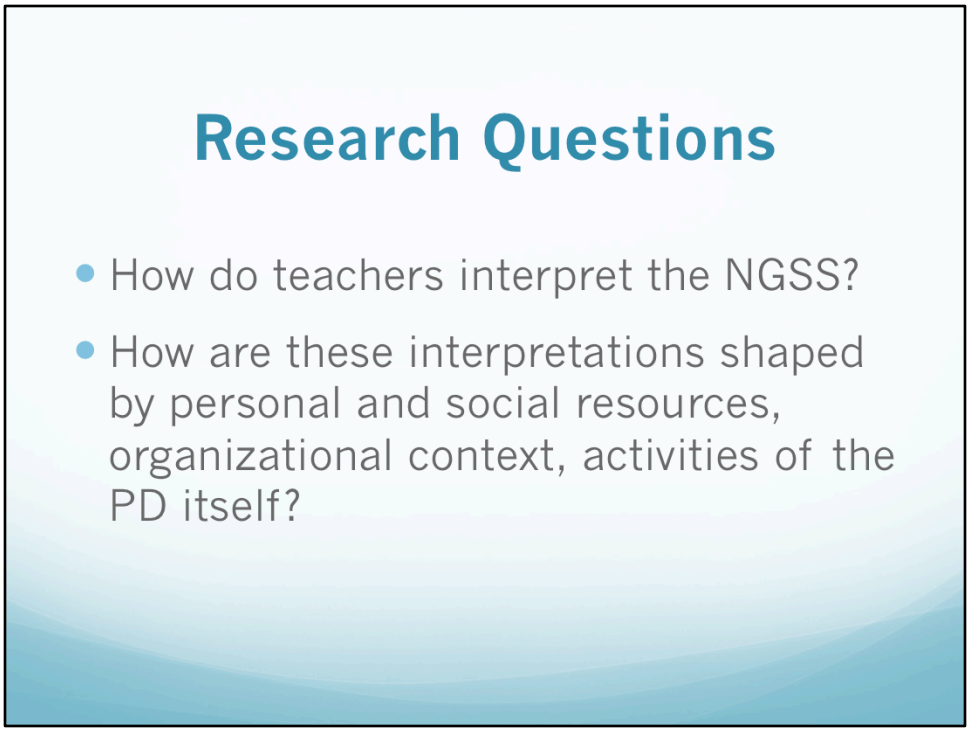


Teachers face myriad messages about what and how to teach from different sources, including teacher evaluation schemes, district guidance regarding instruction, such as "essential questions" and pacing guides, interim and state tests. It is up to teachers – individually and collectively with colleagues – to figure out what messages to attend to, and how to respond to them.

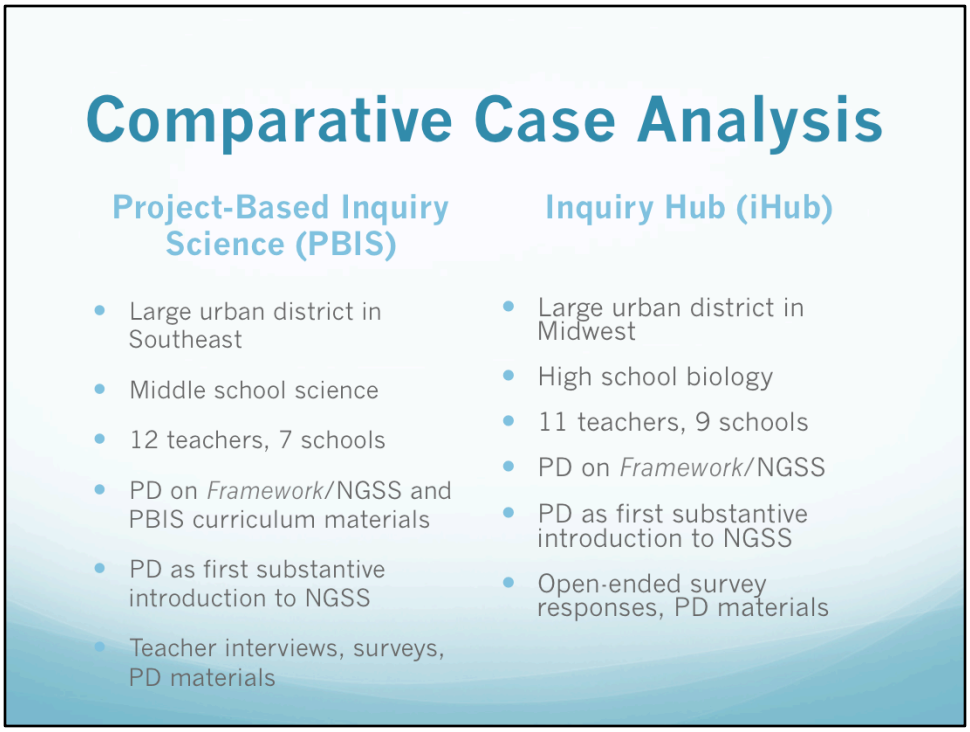


We usually think of PD as a designed context, and the notion of "sensemaking" as what teachers do in relation to the key ideas of the professional development. But in our study – and this is an important element of it – the first introduction of NGSS was through the PD itself. So, the professional development was the first encounter of NGSS as presenting a new definition of what the problems with current science education are, the aims of science learning, and new models of instruction.

We build on this model that views the PD as an occasion for sensemaking in which these new ideas are experienced as shocks from the outside and to include the resources teachers may draw on to develop their interpretations of NGS and inform their implementation. Our model of what influences sensemaking – personal and social resources, as well as features of organizational contexts – draws on a broader literature on policy implementation in education.



We focused on our analysis on two questions: How do teacher interpret the NGSS? and, How are these interpretations shaped by personal and social resources, organizational context, activities of the PD itself?



We focused on two different districts that implemented professional development related to the *Framework for K-12 Science Education* and *NGSS.* These two districts are particularly well suited to the study of PD as an occasion for sensemaking, because the PD sessions in both cases were the first substantive introduction to the ideas of the *Framework* and *NGSS* for teacher participants. Neither district in which we conducted our research was in a state that had adopted the *NGSS,* but both had district leaders who saw the professional development as an opportunity to build teacher capacity for *NGSS.* The two district contexts were similar in two other respects, in that both were large urban districts that served diverse populations made up of predominantly White, Latino/Hispanic, and African American students and the participants were secondary teachers (in the first study, middle school teachers, and in the second study, high school teachers).

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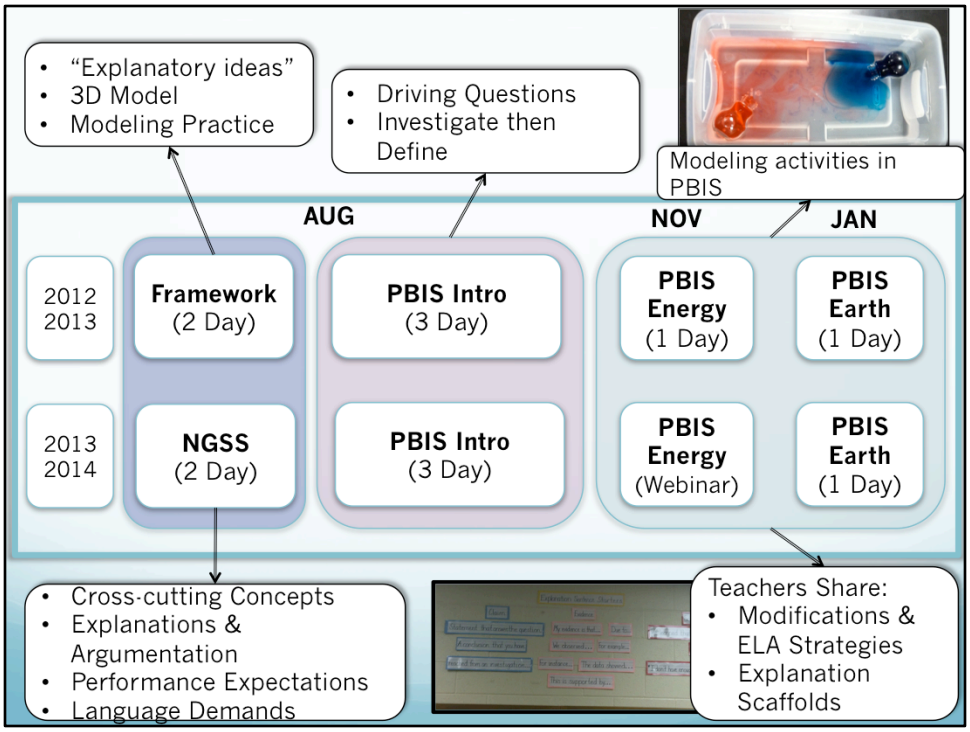
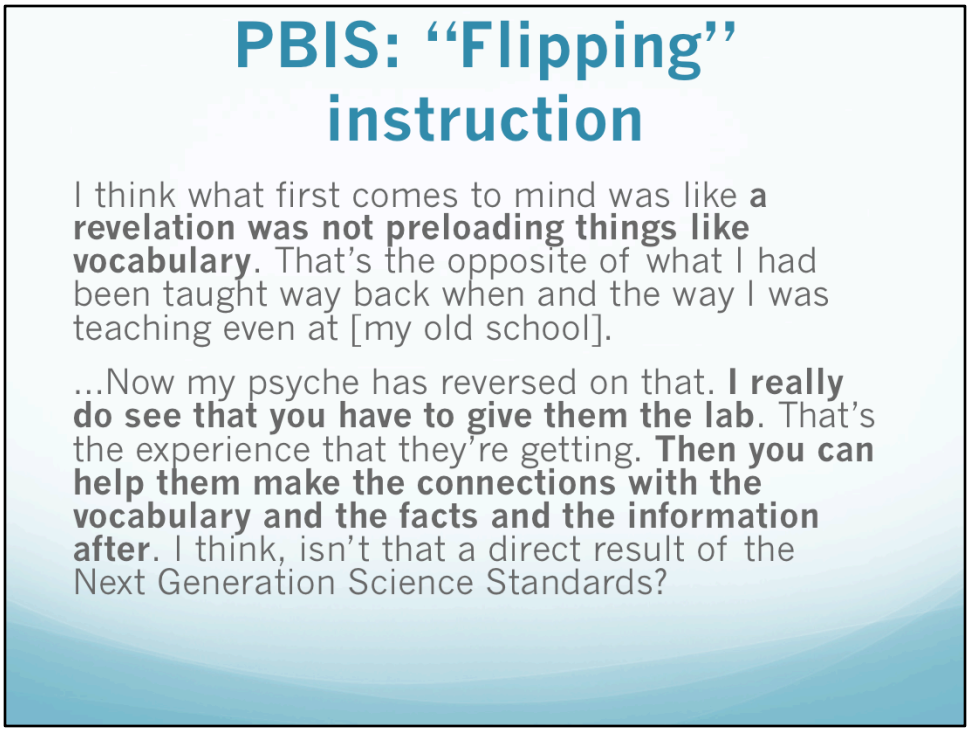
CASE 1: PBIS

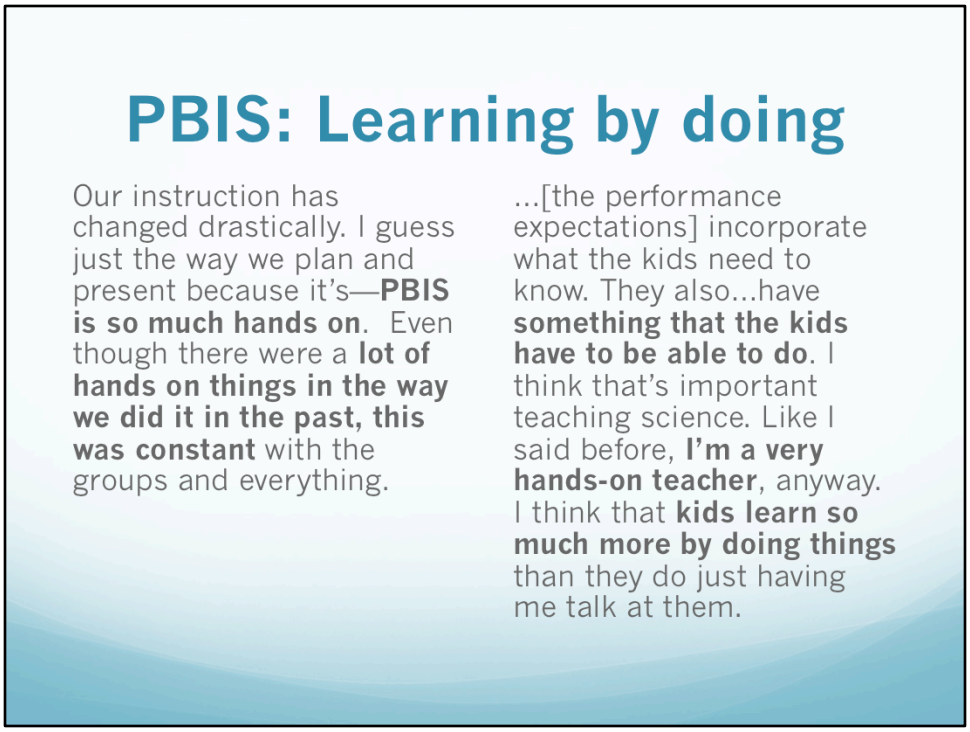


To situate my discussion of the PBIS study, I want to first provide an overview of our PD design. The teachers in PBIS participated in PD on both the Framework and NGSS and on the PBIS curriculum materials. The Framework and NGSS PDs took place toward the end of August in both years. During these workshops, teachers learning about some key ideas about the Framework and NGSS, and they also had time to participate in activities that embodied the goals of the standards. The PBIS curriculum PD then took place directly after the Framework/NGSS PDs, then again in November, and in January. The curriculum-focused workshops centered on particular modeling or explanation activities as well as time for teachers to preview upcoming units and share their adaptations and ELA strategies with each other.

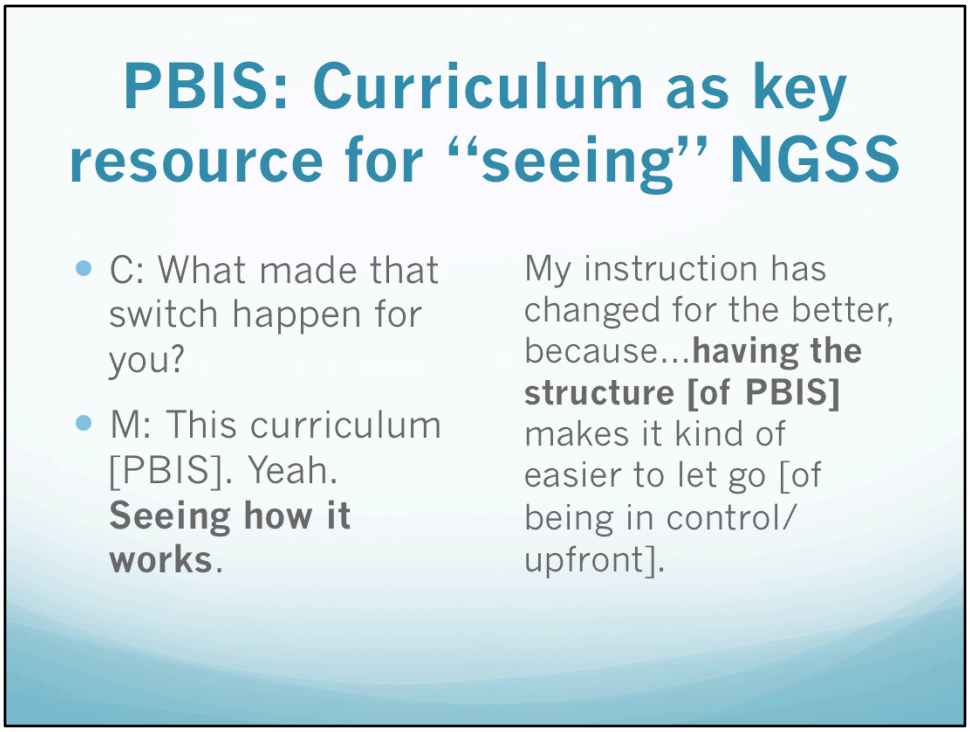


One take away for teachers was the idea that NGSS was about flipping the instruction. That is, rather than – what teachers characterized as "preloading" content – they engaged student in an activity first then then made content and vocabulary connections. For example, when I asked Marcus if there as anything from the PD workshops that felt new to him or different from what he'd thought about teaching and learning before. His response was that he had had the revelation was not preloading things like vocabulary. He say, that's the opposite of what I had been taught and the way I was teaching even at my old school. Now my psyche has reversed on that. I really do see that you have to give them the lab….Then you can help them make the connections with the vocabulary and the facts and the information after. I think, isn't that a direct result of the Next Generation Science Standards?

In talking about this idea of reversing the order of instruction, Marcus indexes both his prior learning about good instruction – the opposite of what I had been taught way back when – as well as former styles of instruction.

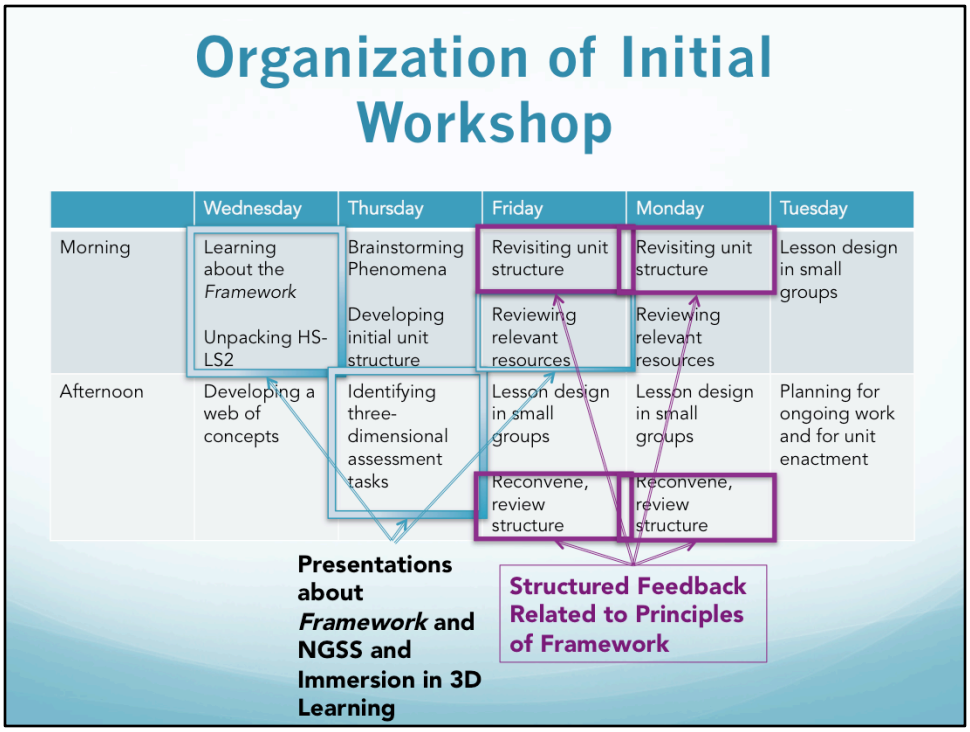


In addition to the idea of flipping or reversing the order of instruction, teacher also described the NGSS as an approach of learning by doing. Kate and Rich taught at the same school, planned together, and tried to teach the same lessons, more or less. When asking whether their instruction had changed since participating in the study, and if so, how, Rich replied, Our instruction has changed drastically. I guess just the way we plan and present because it's (now talking about the curriculum) PBIS is so much hands on. Even though there were a lot of hands on things in the way we did it in the past, this was constant with the groups and everything. We can see Rich drawing on his personal and social resources here – he's considering his and Kate's (notice the we) prior practice in relation to the NGSS. Here, Rich references both continuity – this is something we've done - and novelty – but this is a different degree/level of what we've done before. Additionally, Alice notes this continuity and novelty in her description of the NGSS – She says that she's always been a hands-on teacher anyway; and that kids learn so much more by doing. She could see how these standards aligned with her ideas about instruction.



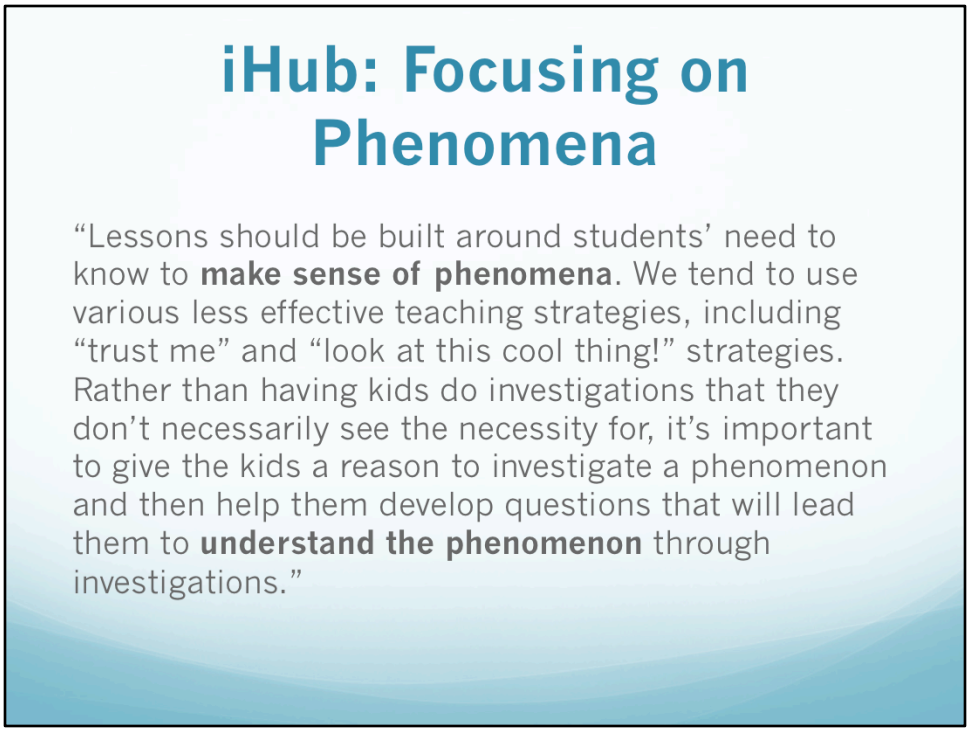
Finally, for PBIS, teachers drew strongly on the curriculum resources to implement ideas present in NGSS. Curriculum allowed for teachers to "see how it works" to do this kind of instruction. At this stage, it was less important for teachers to know the standards as it was to have a model for what the standards would look like in practice. Although there is not perfect alignment between the currciulum and the standards, this was not something teachers were thinking about or considering. The PBIS approach, as they called it, was adequate.

CASE 2: iHub



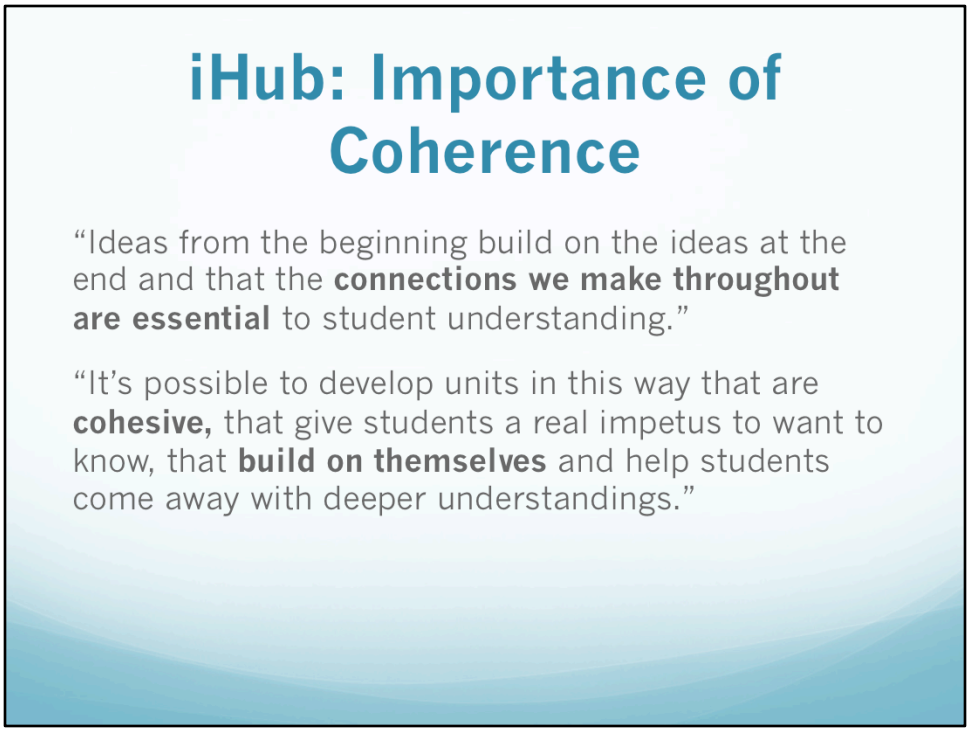
Our workshop goal was to produce the outline of an eight week project based unit on ecosystems, but we set aside intentional time for teacher learning. We had an expert involved in the development of the *Framework* (Brian Reiser) present on the Framework and also engaged participants in three-dimensional learning in the domain – specfically, participants engaged in an activity from the IQWST curriculum that used an agent-based simulation tool, NetLogo.

As we worked to develop the unit structure, we worked in small groups and then would reconvene as a large group and review the work of the different small groups. This was a critical piece of the design for teacher learning – even though we didn't realize it at the time – because the feedback was framed in the language of the *Framework,* provided initially by our expert outsider but eventually appropriated by the group as a whole.

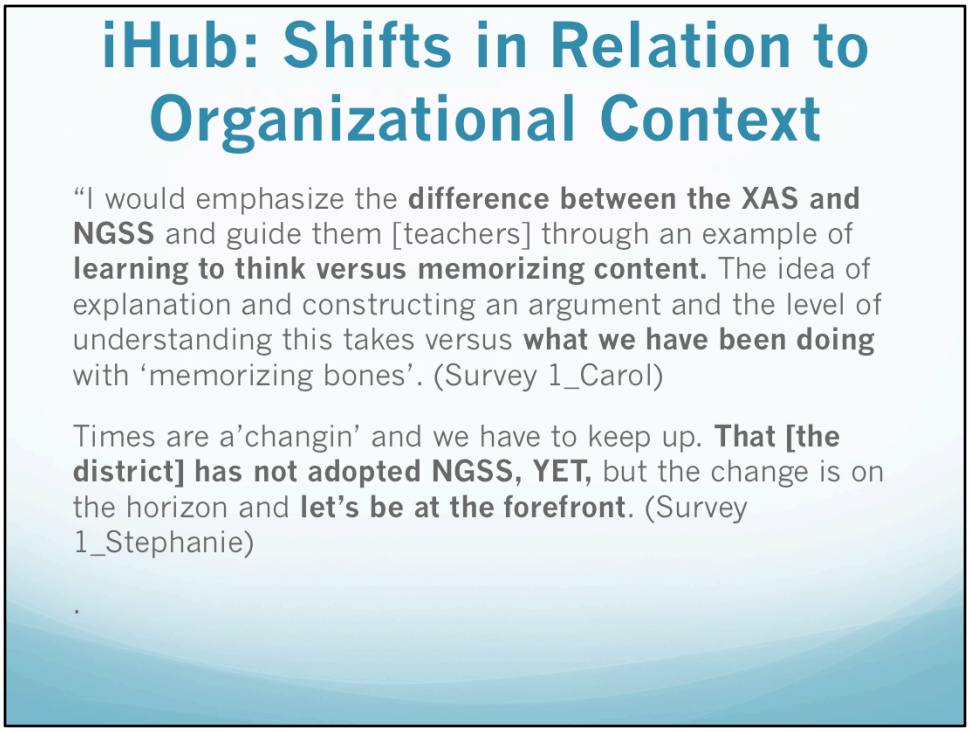


The importance of anchoring a unit and the instruction therein in phenomena resonated with some teachers. In the survey responses, one teacher specifically called out the utility of phenomena to draw in and motivate students to learn, to create a "need to know."

The teacher sees the use of phenomena as a departure from previous strategies teachers "tend to use," perhaps drawing on his personal experiences. The quote illustrates the teacher's attempt to accommodate the shifts called for in NGSS, to integrate the idea of phenomena serving as the driving impetus for a unit. The use of phenomena in investigations seems to cohere with the teachers' existing beliefs of how students should develop understanding through engagement with practices like investigations and questioning.

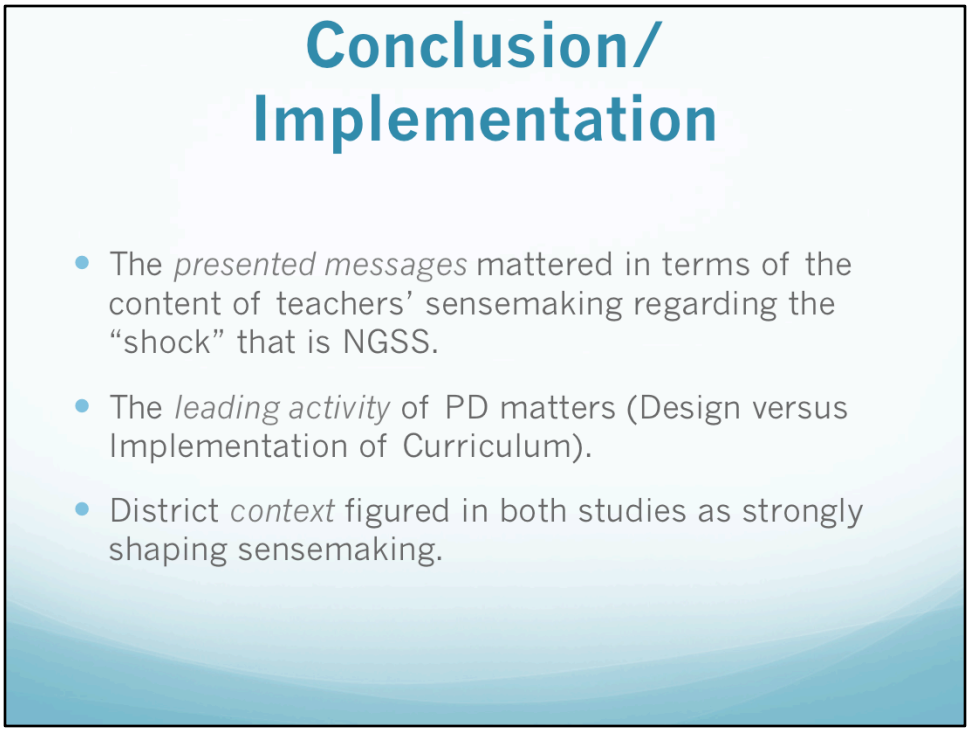


numerous teachers saw the importance of developing an overall coherence for the unit in terms of a narrative structure that is accessible and meaningful for students. Four of nine teachers explicitly referenced the importance of a cohesive presentation, the thematic nature of the unit, or the importance of the storyline tool (sometimes referred to as the "Reiser Diagram").



In general, teachers seemed to acknowledge the significant shifts called for in the NGSS and the challenge of developing a new unit that embodies these shifts. Five of nine teachers explicitly discuss in their surveys how the approach called for in the *Framework* and NGSS departs from previous approaches to science education. In particular, some teachers seemed to recognize the magnitude of shifting to an integrated or more three-dimensional approach to science learning and notably emphasized the shift of integrating practices to explore fewer core ideas.

This teacher invokes the larger policy context of the district; the NGSS has not been adopted "YET" but she foresees a coming policy change. This quote seems to indicate that the teacher sees the NGSS as a beneficial change, suggesting that the district, which she sees herself as a part of as indicated by her usage of "let's" (i.e. let us), should spearhead efforts for adoption.



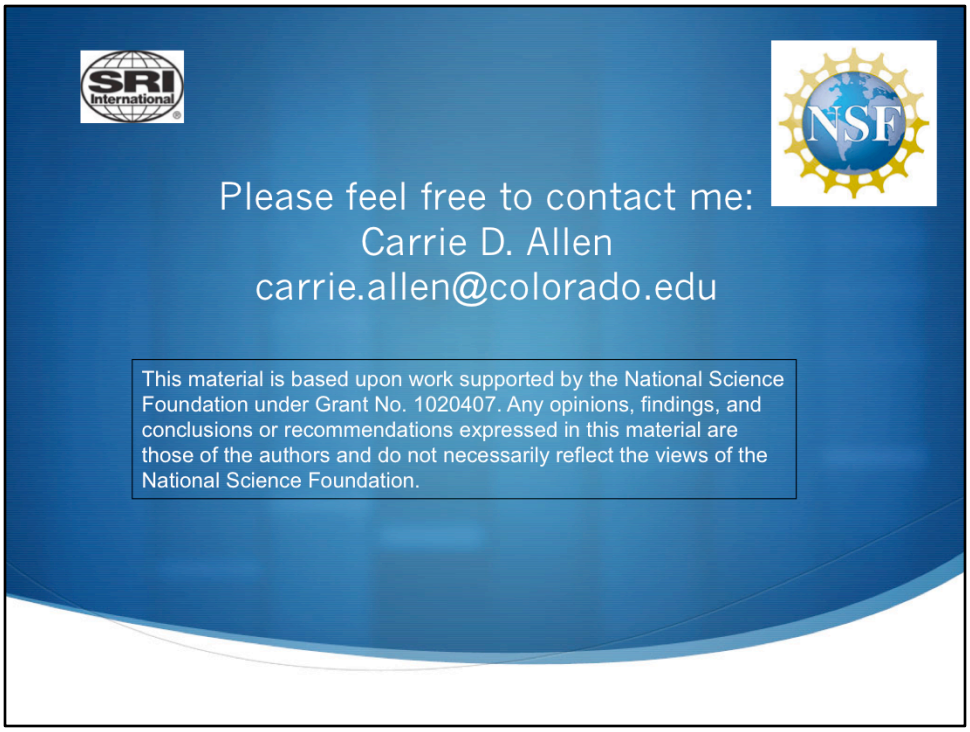
In one, the focus was on differentiating practices from inquiry, with a strong focus on explanation. In the second, the focus was on coherence. We saw much more uptake of the messages in the iHub professional development.

We suspect, though, this has a lot to do with the leading activity for PD – because teachers had to wrestle with its meaning and apply it.

Teachers wrestled with disjunctures between state and local policies, and also between local district policies that were already in place, even as the districts moved forward.

Conclusion/Implications

- Enacting effective PD requires knowledge of local context, including participant experience and concerns
- Curricula play an integral role in offering a model for NGSS implementation
  - in the case of pre-developed curricula, teachers should have opportunities to critique/modify to best fit standards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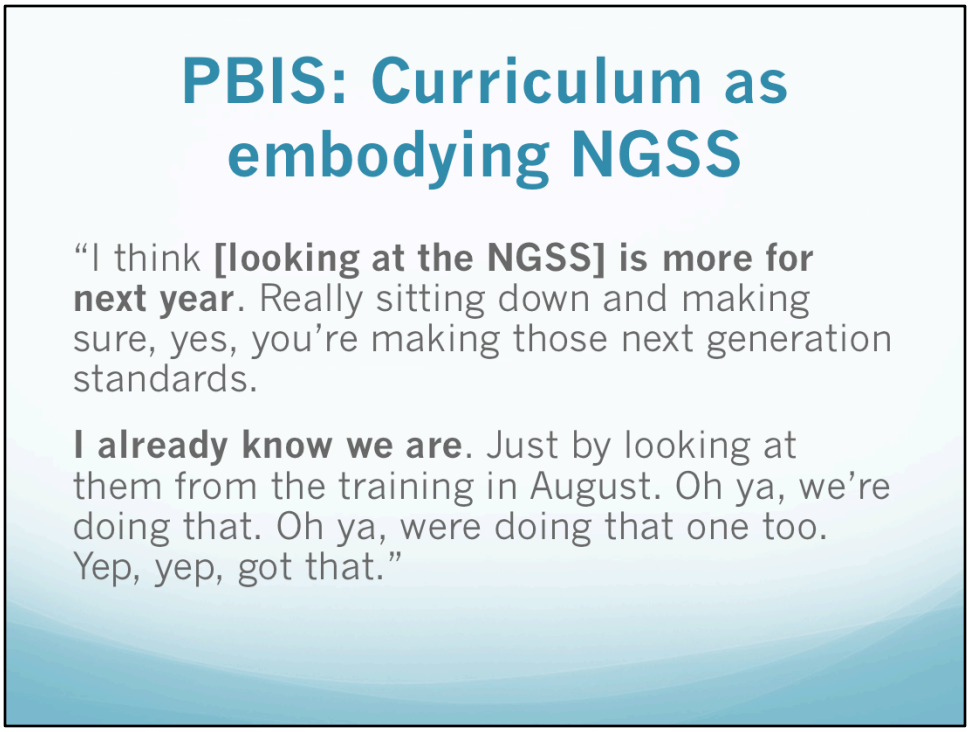
PBIS: Learning by doing

How would I describe it? Giving the kids **hands-on experience**, investigating, answering a question, collecting data, analyzing, **doing the principles of things** like problem solving, inquiry. **The content is almost secondary to the process**.



Curriculum as a resource
Curriculum allowed for teachers to "see how it works" to do this kind of instruction. At this stage, it was less important for teachers to know the standards as it was to have a model for what the standards would look like in practice. Although there is not perfect alignment between the currciulum and the standards, this was not something teachers were thinking about or considering. The PBIS approach, as they called it, was adequate.