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A Framework for Assessing Teachers' Readiness for Pedagogical Transformation

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Abstract: Creating conditions that empower science teachers to innovate in their classrooms is important yet challenging. The Next Generation Science Standards (NGSS) invite teachers to educate in ways that differ markedly from traditional pedagogy. We posit that this transition requires more than asking teachers to implement novel instructional approaches after participating in a few professional development sessions. We present a preliminary framework for assessing whether teachers and learning communities have the beliefs, abilities, and motivations necessary for sustainable transformations.

Introduction: The need for readiness evaluations

Science teachers feel pressure to align with the Next Generation Science Standards (NGSS) and embrace innovative methods and technology. Yet, their daily classroom practices rarely incorporate these innovations (van Driel, Beijaard, & Verloop; 2001). Research into this phenomenon includes studies of professional development (PD) effectiveness and teacher learning, beliefs, and resistance to change. Findings have yet to uncover how to reverse the trend (Wang, Olivier, & Chen; 2020).

Tensions surface when teachers and students are expected to replace traditional activities, including lectures, worksheets, teacher-led step-by-step labs, and tests, with innovative activities, including student-led inquiry, developing and using models, arguing from evidence, and constructing explanations. The aim of the present study is to identify the specific elements creating tensions and barriers that undermine teachers' readiness for change.

Video recordings of a summer PD and follow-up interviews provide insights into these tensions and barriers. Themes that emerged during a grounded analysis of the data were found to relate to Bandura's human agency work and the influencer framework by Grenny et al., (2013). Drawing on our grounded analysis and these two literatures, we present a new framework, which we call the *agency influence* framework. The framework points to areas within an education system that need evaluation and intervention before change can begin. This education-specific change-readiness framework provides direction for in-depth investigation of any educational entity's fitness to fully embrace innovation. We hypothesize that following a framework like the one presented can facilitate pointed inquiry and discussion that increase the chance for successful uptake of educational innovation in the classroom. Our discussion of the framework below documents its chronological unfoldment.

Empirical context

Data were drawn from a 4-week professional development institute, during which three middle school science teachers created NGSS-aligned instructional materials. These materials introduced students to computational modeling microworlds and scaffolded their use of the microworlds to construct their own theories of different phenomena. During our time together, the teachers spontaneously expressed the tensions and barriers they experience when asked to implement new pedagogies and technologies in their classroom. Recordings of the PD sessions were transcribed and then coded to capture and categorize teacher utterances like the ones below.

> "We have to move on [to] keep the pace, because we have to cover all the standards that the tests are going to assess students on."

> "What you can do with one kid in 4 hours is probably equivalent to what you do with 35 kids in 8-12 hours. With more kids, it takes a lot longer."

> "It's because we have this evaluation system in place, that we have to give the tests, that we have to focus on the grades, because we're held accountable to the grades. "

> "I'm going to be like the typical 8th grader because I don't like coding. I'm not engaged in it. I don't like to do it [and] don't want to do it. I'll do [it] as a means to an end."

These utterances conveyed that our teacher partners were not empowered to take a new approach to scientific inquiry in their classrooms, despite their desire to do so. We have created the agency influence framework for making sense of the tensions and barriers experienced by our own and other teachers. The framework integrates components from both Bandura's and Grenny's work on agency.

Making sense of the influences on teachers' readiness for change

Bandura's (2001) work suggests that underlying influences deterring teacher action can be found within their beliefs, sense of self-efficacy, abilities, and motivation. Teacher utterances during the summer PD contain evidence of reduced ability and self-efficacy, as well as lack of motivation and negative beliefs. Bandura (1997) found that these kinds of affective traits can limit individuals' experience of agency. While Bandura's findings describe individual agency, they lack insights into educational resistance toward pedagogical transformation. Grenny et al. (2013) investigated influences that constrain agency and prevent people from changing behaviors in schools and societal situations where change is difficult. Grenny's key findings build upon Bandura's ability and motivation work by creating three subcategories: personal, social, and structural. A matrix showing the cross-product of *ability* and *motivation*, with dimensions of *personal*, *social*, and *structural* influences, is shown below in Table 1. These subcategories form the backbone of our agency influence framework, shown on the next page in Figure 1.

Table 1: Personal, social, and structural sources of influence on ability and motivation

	Ability	Motivation
Personal	The individuals have skills, understanding, strengths or tools to do the right thing.	They want to engage in the new behavior.
Social	Resources, training, encouragement & support are provided by the community.	Leaders and community members encourage and reward the new behavior.
Structural	System constraints or expectations and environmental characteristics such as space, time, tools, or other elements are provided.	Systems are rewarding the right behaviors that are effective in the new behaviors.

Grenny et al.'s (2013) findings show that people are more likely to change behavior when all six sources of influence support that change. We evaluated the six sources of influence against the utterances of the teachers (Table 2). Evaluating the teachers' talk in this way brought to light structural systems, social relations, and personal states of being that influence behavior decisions. Other phrases like, "I'm not good at coding," correlate with Bandura's (2001) belief influences. These are also included in the table below.

Table 2: Evaluating teacher utterances to determine sources of influence

Teacher utterance	Source of influence	Explanation
We have to move on, [to] keep the pace, because we have to cover all the standards…	Ability structural	A structure is causing and rewarding things the teacher doesn't feel capable of changing.
	Motivation personal	The teacher doesn't enjoy or want to engage in the behavior.
… I don't like coding. I'm not engaged in it. I don't like to do it, [and] don't want to do it. I'll do [it] as a means to an end.	Ability personal	Skills, resources, or training are needed.
	Ability social	The community doesn't provide support.
	Motivation structural	Ineffective actions are rewarded.
	Motivation personal	The teacher doesn't enjoy or want to engage in the activity.
It's because we have this evaluation system in place, that we have to give the tests, that we have to focus on the	Ability structural	Systems don't enable choice .
	Motivation structural	Systems don't reward actions outside tests and grades.
	Motivation personal	The teacher doesn't enjoy the activity.

grades, because we're held accountable to the grades."	Motivation social	People are measuring test and grade performance not NGSS skill development.
I'm a little overwhelmed right now, because I've had no experience with the aggregate-pattern theory building.	Belief personal	The teacher is questioning their ability with something new.
	Belief social	The teacher is questioning getting the support they need.

Recognizing the importance of belief, we crafted personal, social and structural influence questions following the pattern of Grenny et al., (2013). We present these questions in Figure 1. When Bandura discussed agentic action he included self-reflectiveness, self-reactiveness, self-influencers and intention. We saw that self-reflectiveness plays a role in evaluation of beliefs, self-reactiveness helps define ability, and self-influencers get to the root of motivation. Intention is included as a final step to help leaders and staff clarify their courses of action and commitments.

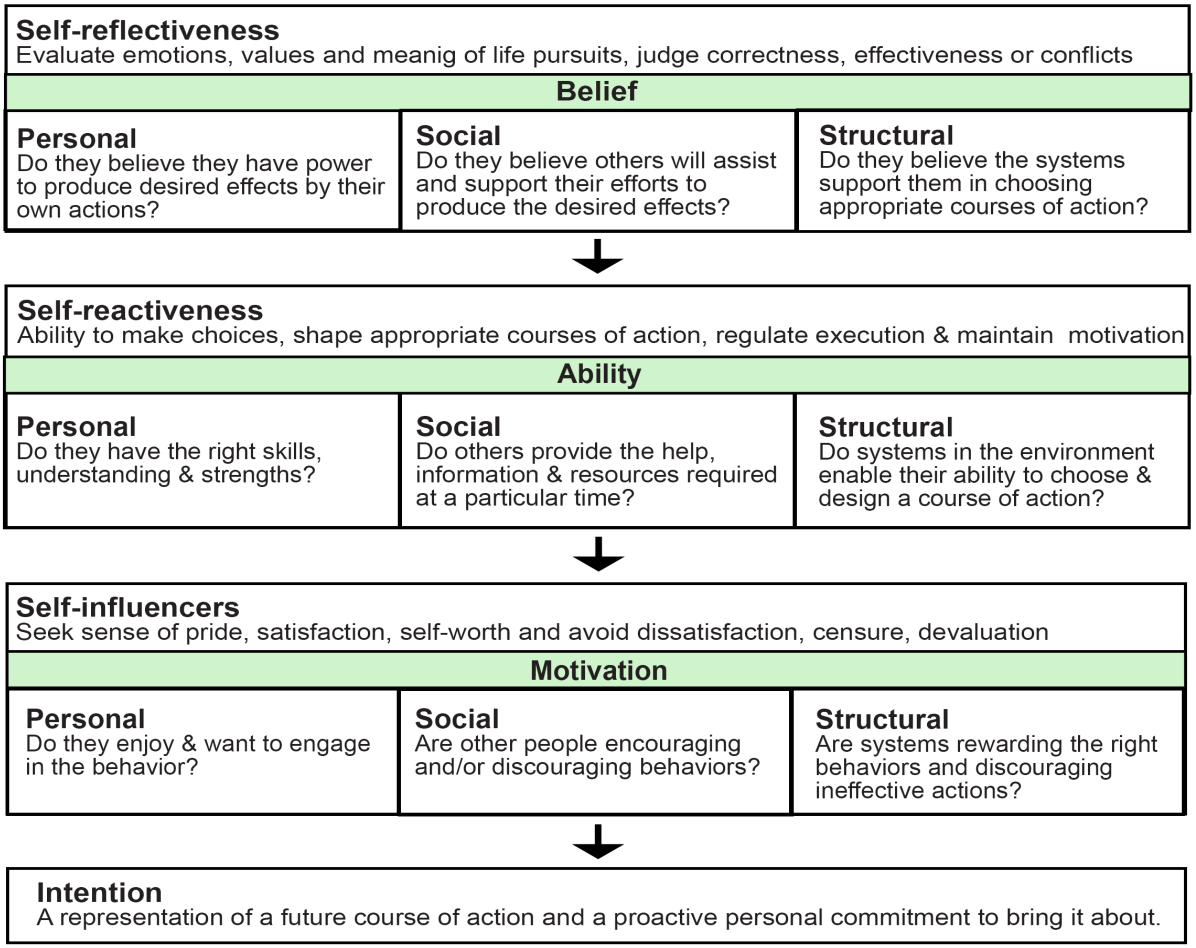

Figure 1: Agency influence framework

This framework can be used to guide education leaders through self-reflection, where they consider and discuss the state of their communities' beliefs, abilities, and motivations with respect to the proposed pedagogical changes. The discussion outcomes can be used to set a course of action supported with personal commitment to the new goal. If it is determined that the community is not ready, areas that need preparation are illuminated. Table 3 takes each part of the framework and provides possible questions education leaders can ask as they follow the guide to investigate their learning community's readiness for pedagogical transformation.

Table 3: Example of questions a leader might ask to implement the framework and evaluate their community's readiness for change

Framework component	Questions a leader might ask as they go through the readiness assessment.
Self-reflectiveness	What school culture elements cause teachers or students to feel unsafe evaluating emotions, values, judging effectiveness, or addressing conflicts? What changes do we need to make?
Belief: Personal, Social, Structural	When do teachers or students believe they do not have power to do what they feel is best for their classroom or learning? Do they believe others will assist them? When do they feel that culture/systems restrict their ability to make choices incorporating new ideas? What in our culture/systems need to change?
Self-reactiveness	Armed with beliefs, teachers need time to contemplate courses of action, regulate execution and maintain their motivation. What adjustments are needed to give this time?
Ability: Personal, Social, Structural	What skills, understandings or strengths are the teachers lacking to accomplish this goal? What do they need? When do they need it? What systems/culture are restricting their ability to take this course of action? What changes need to be made? How will we do it?
Self-influencers	When someone has taken risks to try something new, what are the responses? What are unhealthy ways we censure, devalue, or communicate dissatisfaction? What changes need to be made so that a sense of pride, satisfaction, recognition is given for the risk they have taken and value the have provided to the community?
Motivation: Personal, Social, Structural	Are cultures/systems requiring actions that are ineffective, lack time, space or engagement? Do rewards/milestones encourage or discourage people taking actions they value as most important? What culture/system changes are necessary?
Intention	Do our teachers and students have the stewardship to plan a learning course of action and a personal commitment to bring it to fruition? What prohibits this? How do we change it?

Conclusion

The agency influence framework provides a systematic approach for evaluating a learning community's readiness for change. It asks us to consider the multidimensional, complex, and complicated conditions associated with enacting change in pedagogy, tools, and practices. This new framework is intended to encourage readiness evaluation before attempting to implement new technologies, practices, or pedagogies in learning communities. Future directions include studying the capacity of this framework to help learning communities identify and create supports before attempting a pedagogical transformation.

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Acknowledgments

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