Teaching Statement

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Overview. I believe that effective science curriculum and instruction can be guided by multiple theories of learning. In my opinion, the choice of one theory over another in the design of learning should be guided by the purpose of the learning and the particular challenges students face when learning in different domains. If, for example, learners are engaging with phenomena where there are strong pre-conceptions, such as the physics of falling objects, then instruction designed on the basis of conceptual change theory, or Piagetian constructivism, might be warranted. However, if the objective is to help students construct meaning from a text, then literacy-based instruction guided by socio-constructivist ideas may be more appropriate. Finally, if the purpose of learning is to engage students in practices such as the analysis and interpretation of data or scientific argumentation, then a situated perspective on learning might be the best way to help students become competent users of these scientific practices. My pluralistic stance on science teaching and learning is founded upon the assumption that, at present, there is no universal theory of how people learn, or for that matter, how people behave in learning situations because teaching and learning are complex cultural endeavors. That does not mean that all theories of learning are equally valid or that there is no basic knowledge about how to design effective curriculum and instruction. Instead it means that the task of the expert is to determine which theories of learning are applicable in which learning situations. In this teaching statement, I explain my philosophy on effective curriculum and instruction in K-12 science teaching and also my framework for science teacher education. Then I provide an example of how I use different learning theories and instructional tools to design science teacher education courses aligned with my philosophy on K-12 science teaching.

K-12 science teaching. Effective curriculum and instruction in science requires instructional coherence, assessment of student thinking, attending to learners' prior knowledge and experiences to help them construct new knowledge, and accounting for motivation and student identity. Regarding coherence, effective science teaching involves the design of objective driven lesson plans through backwards planning frameworks. These lessons should form an overarching science narrative that targets an essential question that is meaningful to students and based in the core ideas of a discipline. Ideally, the big ideas in such lessons should be taught in a way that makes them relevant to students' identities to activate their motivation to learn. Motivation can be accomplished in many different ways, but I try to establish motivation by anchoring learning in a phenomenon or problem that is relevant to student identity. Thus, a core aspect of teaching is that teachers know their students. Regarding assessment, science instruction should begin with a pre-assessment of the learner's prior knowledge because new knowledge is built upon, contrasted with, and constructed upon the learner's previous knowledge. During the course of instruction, teaching should be guided by embedded formative assessments. At the end of instructional units, students should have an opportunity to demonstrate their understandings through a performance assessment that requires them to apply newly constructed knowledge in a novel circumstance. Each of these phases of teaching should provide students with feedback on their learning either through the use of rubrics or through written and spoken feedback framed by a "growth-mindset" perspective that values effort, repeated practice, and perseverance.

Science teacher education. As a science teacher educator, I design and teach courses modeled on my K-12 science curriculum and instruction principles. The big ideas that organize my teacher education curriculum are the goals of science education (e.g. democratic, cultural, utilitarian, or economic imperatives for teaching science), assessment of student thinking, instructional coherence in curriculum design, instructional tools based in learning theory, disciplinary literacy, and equity in science education. The tools that I use to support the learning of these ideas are video analysis, reading and discussing instructional dilemmas in teaching cases, curriculum and assessment critique, reflecting on personal science learning. Using these tools, I provide opportunities for teaching candidates to build new knowledge through argumentation, discussion, debate, and academically productive talk.