

Collaborative Research | STRIDES: Supporting Teachers in Responsive Instruction for Developing Expertise in Science

Overview. Supporting Teachers in Responsive Instruction for Developing Expertise in Science

(STRIDES) is a four-year *Level II Design and Development proposal*, addressing the teaching strand, submitted to the DR K-12 program at the National Science Foundation. STRIDES supports teachers to customize the curriculum to address diverse students' evolving ideas and achieve the multi-dimensional proficiency called for by the Next Generation Science Standards (NGSS). STRIDES catalyzes a new approach to teachers' curriculum customization. STRIDES will improve the evidence teachers have to make customization decisions by collaborating with the Educational Testing Service (ETS) to advance natural language processing (NLP) methods. New NLP methods will generate detailed evidence of students' progress in linking NGSS identified cross-cutting concepts to form explanations of disciplinary core ideas. The STRIDES customization options will enable teachers to use research-based activities to respond to the evidence of student learning. STRIDES will guide teachers to reflect on data documenting the impact of their customization decisions on students' learning and to modify their plans for future runs. Study of customization at multiple school sites with diverse students and teachers supports the development of flexible curriculum units and technologies that can easily be used by new teachers and schools.

Intellectual Merit. Prior research demonstrates the powerful impact of responsive instruction on students' disciplinary engagement and learning. Due to teachers' limited access to formative assessment data and a prescribed curriculum, responsive instruction has been difficult to achieve (Brown, 2011; Engle & Conant, 2002; Ruiz-Primo & Furtak, 2007; van Zee & Minstrell, 1997). STRIDES addresses this problem by integrating advanced technologies with NGSS-aligned curriculum units to enable teachers to efficiently and effectively customize curriculum to address patterns in their students' understandings. Engaging in the STRIDES customization cycle will support teachers to provide responsive instruction that guides all students to develop the three-dimensional proficiency described by the NGSS. STRIDES will implement a customization cycle where teachers plan modifications to materials, implement the customization in a classroom, observe impacts, and reflect on the outcomes to refine the instruction. STRIDES will enhance the curriculum customization cycle by providing teachers with a *Teacher Action Planner (TAP)*. The TAP will communicate patterns in students' evolving understanding in real time, and provide research-based customization activity choices for the teacher to address the patterns. STRIDES research will develop NLP methods that generate fine-grained analysis of student responses, including recognizing specific ideas, inaccuracies, and vague or missing information, to create the patterns communicated in the TAP. STRIDES will identify the customization options teachers find most beneficial for guiding students in NGSS and the customization activities that strengthen student learning outcomes. The customization activities build on the kinds of modifications teachers are calling for currently to modify their curriculum to implement NGSS instruction.

STRIDES will refine tools that support teachers reflection on the impact of customization decisions. Documenting insights can promote teachers' collaborative refinement of the curriculum design and teaching practices during professional development workshops and in individual reflections. We will work with schools to co-design tools and test their effectiveness in trial and redesign studies.

Broader Impacts. The STRIDES research program can broaden participation in science learning and improve learning outcomes by supporting teachers to customize the curriculum to ensure all students are able to engage in the multi-dimensional learning described by the NGSS. Insights from this research will be captured in automated scoring algorithms, empirically tested and refined customization activities, and data logging techniques. These insights will support teacher reflection and can be used by other research and curriculum design programs to enable teacher customization. To ensure that these opportunities reach a broad group of students, STRIDES materials will be disseminated widely and made freely available to teachers and school districts as part of WISE, used currently by over 18,500 teachers.