

Overview

SAIL (Stimulating AI Learning in K-12 with fossil sharks) is submitted as a DTI (Developing and Testing Innovations) ITEST project. Sharks have ruled the Earth's oceans for 400 million years and are widespread as fossils in marine sediments worldwide. Giant extinct marine predators, such as the 20m-long Megalodon shark (*Otodus megalodon*), captivate the imagination of learners of all ages. Like dinosaurs, fossil sharks are a charismatic group that can be used to develop knowledge and stimulate interest in STEM. Seemingly unrelated to fossil sharks (until now), Artificial Intelligence (AI) is ever-more pervasive in modern society, although public understanding of this field has lagged behind. We will harness public interest in fossils and integrate AI to stimulate STEM teaching and learning in Florida's Title 1 schools. By engaging teachers and students in the use of machine learning to identify fossil sharks, we will study human beliefs and conceptions of AI so that this domain is no longer a conceptual "black box."

In April and May 2021, we conducted a pilot professional development program with K-12 STEM+C teachers in Flagler County, Florida. We used Google's *Teachable Machine* for fossil shark tooth identification. Our assessments indicated that teachers are interested in fossils and AI and find these topics relevant to their curriculum. However, they hold many science and AI misconceptions, as well as lack self-efficacy for teaching science with AI. This pilot indicates to us that further research will yield novel insights.

Intellectual Merit

We will study: (1) students' and teachers' STEM knowledge, beliefs, and conceptions; and (2) the nature of science using AI applied to the science of paleontology. We will explore several interconnected learning research questions about how STEM+C middle school teachers and students better understand AI through the lens of fossil sharks. Our primary audience will include 76 Florida Title I middle school teachers and their students during the three-year funding period. At its peak in year 3, SAIL will potentially reach about 7,500 K-12 students with STEM+C content, nature of science, and 21st century career opportunities. Our SAIL project aligns with NSF's strategic Big Ideas for future investments, i.e., the (1) Human-Computer Frontier and (2) Rules of Life. This is also an exciting time at our institution and in Florida because of increased emphasis on AI in instructional activities in all disciplines—not just computer science, but also other STEM education domains, and related fields.

We will leverage the statewide K-12 infrastructure developed through our *Scientist in Every Florida School* program centered at the University of Florida. This program has cultivated a network of ~1,000 Florida public school STEM teachers in 40 counties and 750 Earth systems scientists, implemented sustained teacher PD, and delivered ~2,000 virtual role model scientist "visits" to classrooms over this past year. Our programs are teacher-focused, i.e., we align our activities for them and include Florida science standards (and NGSS equivalents for broader generalizability) for their specific STEM content needs. The core project team includes two STEM scientists (paleontologists), an educational technology researcher, and an engineering professor in STEM+C self-efficacy and career development. Our design-based research program will use mixed-methods to understand both cognitive and social-emotional outcomes. Technology for Learning Consortium will conduct formative and summative evaluation. We have access to ~300K fossil shark specimens in museum collections and digital biodiversity research databases.

Broader Impacts

SAIL benefits society at large through K-12 public education. In addition, the SEFS program's focus is on Title I schools, with the goal of increasing accessibility to STEM for all students. We will disseminate our outcomes and results via social media, civic organizations, professional meetings, and peer-reviewed journals. Further, we will focus on STEM+C career development for students and accomplish this through focused role model visits to classrooms. In a broad societal context, the public learns from mass and social media that Megalodon still exists (it does not), and that intelligent machines learn by themselves. We will dispel these and other important misconceptions that represent barriers to learning, while helping students develop the critical thinking skills necessary to evaluate which sources of information are reliable.