Gateways to Computational Thinking: Integrating the Arts and Geosciences into Rural Early Childhood Education
A Planning Grant Proposal for the Grand Challenges Initiative (January 2021)

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Central Themes: Public Trust in Research and Information (Primary), Quality of Democracy and Equality (Secondary).


Brief Summary: We wish to help all young children in Wyoming have equitable access to learning opportunities in Computational Thinking (CT), namely decomposition, pattern recognition, abstraction, and algorithmic thinking. These skills are essential for STEAM fields but they also permeate most disciplines, executive function in children, and critical thinking skills necessary for a curious and informed citizenry. We aim to do so through mobile STEAM kits that help students realize the rich geological and cultural resources already available to them. Our approach is at intersection of place based education, arts integration, asset-based (not deficit-based) methods, and culturally grounded pedagogy.

Further Detail: More specifically, we have three components to this project. First, we wish to develop mobile STEAM kits we can send to and from communities in Wyoming. These kits will include objects, samples, tools, and lesson plans related to computational thinking development using the components of geosciences, the arts, and enabling virtual learning. We will draw on students’ prior knowledge, their environments, and their cultural backgrounds to create engaging learning experiences to develop computational thinking. We have a priori designs, but we will also modify and add to the kits as we gain creations from children across the state, particularly any information that would help honor their cultures and places.

Second, we wish to create a free and open online repository for Wyoming students. The cumulative nature of this project means we will soon have a large amount of lessons, activities, narratives, and products related to computational thinking made for Wyoming residents by Wyoming residents. A free and open repository of such materials for children will do permanent good in our state. We believe it can serve as a model to the Rocky Mountain West and later, to the country.

Third, we wish to conduct as many in-person and online field visits from the PIs (as is possible in our current circumstances) to engage with students and their teachers. This component will be very important in the current planning phase so that we may begin the project by listening to Wyoming community stakeholders. More specifically, we have identified the communities of greater Lander and Riverton, WY because of the PIs’ existing relationships there and the
potential for new relationships (e.g., more members of the Wind River Reservation communities).

**Further Detail on Central Themes:** Recent events in Washington, DC have underscored that our democracy hinges on an educated population capable of discerning misinformation from fact, understanding and trusting research and expertise, and harboring critical thinking skills. Such development is contingent on equitable access to educational resources and experiences. Problem solving skills, such as computational thinking, are of particular significance in this regard and they must be fostered during formative years and continuously cultivated through community-focused efforts. The underpinnings of engaged public life, an equitable society, and our democratic process depend on it. Two sentences in particular from the Grand Challenges call for proposals align closely with this research team’s purpose: “By ensuring students throughout the state have a solid, equal basis of education and exposure to research, UW can prepare the next generation of informed citizenry” and “UW can utilize faculty and stakeholders that are willing and able to support PK–12 schools, teachers, and students both on campus and across the state.”

**Partners:** We will further develop relationships with several partners and we are excited by the likelihood of more partners based on our project’s broad appeal. Current partners are: Wyoming Arts Council, Wyoming Early Childhood Outreach Network (WYECON), Wyoming Early Childhood Professional Learning Collaborative (WYECPLC), Purple Bus project (which serves children in Fremont County and the Wind River Reservation), Wyoming Department of Corrections, and Wyoming Public Radio.

**Work Plan:** During the planning phase, our work plan is to set aside time to work closely with stakeholders in greater Lander and Riverton to create and pilot interventions that are meaningful to them. However, meaningful planning and interview sessions necessitate compensating Lander and Riverton stakeholders for their time. Our short-term goal is to gather empirical data and best practices about how children find avenues into computational thinking through geosciences and the arts. We will publish studies based on these data in scholarly journals in a variety of fields. Pending funding from the Provost’s Strategic Investment Fund, our mid-term goal is to have at least one complete STEAM kit that is operational and suitable for a pilot study. With these preliminary data, we will propose a scaled up project to NSF’s ITEST program, which is designed to help marginalized students gain access to education that supports STEM fields.

**Budget:** Our total budget for this phase of the project is $19,500. The line items are Lander/Riverton area teacher stipends, faculty stipends and fringe costs, undergraduate student stipends, virtual reality (VR) equipment and headset, smart phones, tablets, binary cards, art supplies, early childhood music instruments, cleaning supplies, shipping costs, rock tumblers, and a KIBO (introductory robotics kit for children). A detailed line-item budget is available upon request.
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Will use the funds to further develop a network of partners across Wyoming and test ideas in two locations!