Many future jobs are remote and require computational and collaboration skills. For example, app and web developers are required to be proficient coders; cloud administrators and database managers must be able to converse with researchers using cloud and database resources; graphic designers use highly technical software and must meet the demands of various collaborators; and data analysists must be able to find and communicate trends found in data. These jobs are being created at such a fast rate that, by 2020, unless steps are taken to engage new populations in computational thinking, only about 29% of the project 1.4 million new computing jobs will be able to be filled by our nation's college graduates.

However, in today's highly connected world, remote work will be a reality for many of these newly created jobs. Thus, these high-paying computer science jobs will be brought out of big cities and into many rural communities, such as those found throughout Montana. Opening these jobs to a remote workforce could attract workers from, and hence improve income in, Native American reservations and rural communities. Unfortunately, the minorities that could best benefit from these trends are woefully underrepresented in Computer Science programs in primary, secondary, and higher education. The biggest barrier to employing members of these communities in such jobs is that these jobs require computational skills, which is not currently emphasized in the curriculum. In this grant, we propose to introduce computer science as a collaborative discipline that can be integrated into other disciplines, by incorporating computational thinking throughout the current Montana middle school curriculum.

Computer science education, and the opportunities that come with it, do not reach all equally. This disparity is primarily due to lack of exposure and role models. Previous studies have shown that exposing minority students to computer science in a relatable way changes their perspective, as it allows them to see a computing career as a viable path for expressing their creative and professional aspirations. Creating opportunities for the student to relate to the material increases ownership and autonomy within the educational and creative process, and so increases chances of success in the discipline. Our approach is unique, because it leverages storytelling, which is traditionally unrelated to computer science, in order to appeal to Native American students. Storytelling is an essential part of Native American culture, as oral traditions are highly valued.

The study of computer science encompasses a variety of transferable skills. In particular, when trying to solve a problem in computer science, there is a sequence of steps that one must go through: (1) think about the problem, (2) articulate a solution, (3) implement the solution, (4) debug the code, and (5) evaluate the solution. Practicing each of these steps hones computational thinking skills that can be applied in various settings. The central goal of this grant is to develop middle school course materials centered around storytelling that allow students to embody this process. The combination of programming and storytelling will engage students, teach programming and computational thinking, and present computer science as an exciting area of study to a broader audience of students.

To achieve this goal, we must incorporate the following components:

1. Design CS curriculum that can be integrated into the middle school common core. When designing the curriculum, we will leverage both prior work and a variety of freely available online resources. (PIs Fasy, Fischer, and Wittie).

2. Develop lab materials. (CS Undergraduate, advised by PIs).

3. Create culturally appropriate 3D models. (CAD graduate student, NAPI).

4. Pilot the curriculum in a Montana middle school. (All).
5. Evaluate the pilot. (EvalPI).
6. Advertise and recruit teachers. (Gunderson-Izurieta).
7. Develop teaching workshop materials. (PIs Fasy, Fischer, Wittie).
8. Run workshops for middle school teachers, so that they may incorporate the developed materials into their classes. (All).
9. Disseminate the end products in an exhibit at the Museum of the Rockies or through the extreme history project. (NAPI)
10. Evaluate the success of the program: has the strength of the pipeline improved? (EvalPI).

Broader Impact: Increasing Diversity in CS. One of the primary aims of this proposal is to increase diversity in computer science by improving Montana's pipeline from primary education to higher eduction, especially from rural and tribal communities throughout Montana. Computing and advances in technology affect nearly every occupation today, which means that the demographics of those studying computer science should be reflective of the population at large; however, this is not the case. In the Computer Science Department at Montana State University, only ten of the 480 students are Native American; i.e., only 2.1% of our student population versus 4.2% of the MSU student population in general and 6.6% estimated Native American population in the state (according to census.gov). Moreoever, 14% of Montana K-12 students are Native American. Thus, attracting CS students from the middle school population will lead to a potentially huge impact on the current statistics. In particular, one of the objectives of this project is to bring the Native American participation in Computer Science at MSU to par with the state percentage of 6.6%. Within the next five years, we hope to double the percent of Native American and students enrolling in CS, and to increase the diversity in public high school programming courses. Increasing the diversity at these levels will be achieved by generating interest in computer science at the middle school level. Eventually, by emphasizing computational skills early, members of rural and indigenous communities will be able to compete for future computing jobs, as they could work remotely and stay in their communities.