ᎤᎾᏙᏣᎵ (Unadotsali – “They Belong”): Embracing Traditional Ecological Knowledge and Building Belonging in STEM

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Our project ᎤᎾᏙᏣᎵ (Unadotsali – “They Belong”) is one facet of a community engaged research project aimed at promoting both understanding of animal behavior and Cherokee language revitalization among elementary and middle school (K-8) students in the Cherokee Nation. Our **primary goal** is to build belonging in science, technology, engineering, and mathematics (STEM) among Indigenous students, who are underrepresented in STEM. We will facilitate belonging through hands-on activities that center traditional ecological knowledge (TEK), with **special emphasis on animal behaviors**. Our team includes an animal behaviorist (Dr. Jessie Tanner) whose research focus is animal acoustic communication; a middle school teacher (Ms. Sedi Eastwood) at ᏣᎳᎩ ᏧᎾᏕᎶᏆᏍᏗ (Cherokee Language Immersion School) in Tahlequah, Oklahoma; and a cognitive psychologist (Dr. Alissa Baker) with a focus on the relationship between culture and ecological knowledge. All authors are Cherokee Nation citizens and Cherokee learners. We are collaborating with a community advisory board (CAB) of first-language Cherokee speakers and knowledge keepers and the Cherokee Nation Curriculum Team.

Behavior holds a central place in Cherokee TEK. Many Cherokee plant and animal names are descriptions of animal behaviors or relationships between organisms, reflecting an important synthesis between language and behavioral ecology. For example, the Cherokee name for wood fern (ᏲᎾ ᎤᏤᏍᏙ, or yona utsesdo in phonetic transcription) translates to “bear’s mattress” (Figure 1, top). This name refers to the tendency of black bears (ᏲᎾ - yona) to line their dens with ferns. The word for ant, ᏙᏒᏓᎵ (dosvda’li) describes an animal coming and going to and from a position carrying something (Figure 1, bottom). This word specifically refers to typical ant behavior: making repeated trips to and from the nest while foraging. ᏙᏒᏓᎵ (~ant) is a four syllable Cherokee word that takes at least a whole sentence to unpack in English. It is one example illustrating what makes the endangered Cherokee language so special and motivates our project.

Cherokee is what linguists call a “polysynthetic” language, which means it builds meaning by adding morphemes (word parts) together to create words that can convey exceptional amounts of detail. Individual morphemes have meanings that Cherokee speakers understand, and those morphemes can be used in nearly infinite combinations to make new, descriptive words. As a consequence, a fluent Cherokee speaker can hear a word for the very first time and immediately understand its meaning. Thus, Cherokee words that describe animal behaviors or ecological relationships ***inherently*** transmit that

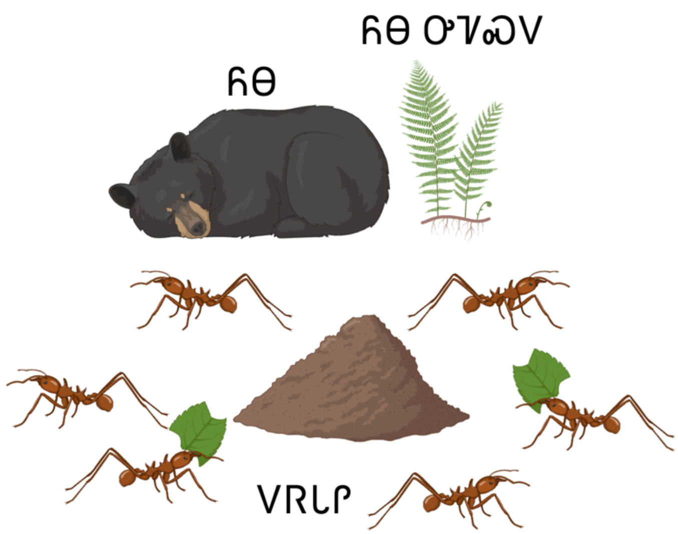

Figure 1. Some organisms are named after their relationships, including behavioral relationships, with other organisms. One example is ᏲᎾ ᎤᏤᏍᏙ (“bear’s mattress”, the wood fern), which is named after the way it is used by black bears (ᏲᎾ). Other organisms are named after their behaviors, including ants ᏙᏒᏓᎵ (”~s/he goes to and from there over and over with something on her/his back”). Illustration made in BioRender.

knowledge to a Cherokee-speaking listener. That feature makes revitalizing our Indigenous language even more important because keeping our language healthy also means maintaining our relationships with plants and animals, fostering understanding of ecological relationships, and perpetuating other land-based knowledge. In pursuit of revitalizing Cherokee language and building belonging in STEM among Cherokee students, our project has three main goals.

First, **document TEK of Cherokee speakers and knowledge keepers.** We will interview 5-20 first-language speakers of Cherokee about their knowledge related to animal behaviors. These interviews will focus on TEK about animal behaviors as well as the ways animal behavior is reflected in the language. These interviews will serve as the basis for the lessons we deliver later in the project, and as language learning resources in and of themselves.

Second, **develop behavior curriculum for classroom lessons that center Cherokee worldview.** Using the interviews with speakers, and in collaboration with our CAB and the Curriculum Team, we will design activities for the Immersion School in Tahlequah, OK. Specific lesson plans will depend on guidance from the CAB and Curriculum Team. We are working with the Curriculum Team to dovetail these lessons with the culturally centered curriculum they already implement in the Immersion School.

Third, **deliver classroom lessons.** We will deliver a unit of 6-8 classroom activities in the Cherokee language at the Immersion School. We will center experiment-based inquiry, which is known to foster belonging in and improve retention of individuals from marginalized communities. Before and after the lessons, we will assess the program's efficacy using validated instruments such as the "Draw a Scientist" test. Sponsored by the Curriculum Team, our Cherokee Nation Institutional Review Board (IRB) proposal is in progress now.

We expect our project to have several outcomes. First, we will **document and preserve relatively rare words related to behavioral ecology.** We will archive interviews via the Cherokee National Archive to foster data sovereignty and further empower language learners. Second, we will **introduce students to TEK and behavioral ecology.** Cherokee people have been keen observers of ecological relationships and animal behaviors since time immemorial and those observations are encoded in the Cherokee language. We will demonstrate that to students, encouraging them to see themselves as scientists, too. Third, we will **provide science enrichment opportunities to Cherokee students.** Students will engage with the scientific method and meet Cherokee STEM professionals so they can see themselves represented in the STEM workforce and build a network of relationships that may help them navigate their career preparation. They will also be introduced to specific Cherokee elders and knowledge keepers so they can build relationships and continue to learn about our TEK and language.

Support from the Animal Behavior Society's Outreach Grant will cover travel costs between the authors (located in traditional Cherokee homelands in East Tennessee and current day Cherokee Nation in northeastern Oklahoma), community advisory board members (distributed across the Cherokee Nation), and the Immersion School (Tahlequah). This travel is important because Cherokee speakers and knowledge keepers involved in the CAB are all elders living in rural communities and may be uncomfortable conversing and teaching online (e.g., via Zoom). Funding from ABS will support underrepresented students, document Cherokee TEK, and contribute to the revitalization of an endangered North American language.