Alaska Science/NGSS Standards and Performance Expectations that Reference Culture or Traditional Knowledge

Standards (Current)	Performance Expectations (Current)	
A. Science as Inquiry **A student should understand and be able to apply the concepts, models, theories, facts, evidence, systems, and processes of life science.**	**A student who meets the content standard should:** SA3: develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.	
	The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by:	[3][4] SA3.1 observing local conditions that determine which plants and/or animals survive (L) [5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive [6] SA3.1 gathering data to build a knowledge base that contributes to the development of questions about the local environment (e.g., moose browsing, trail usage, river erosion) (L) [7] SA3.1 designing and conducting a simple investigation about the local environment (L) [8] SA3.1 conducting research to learn how the local environment is used by a variety of competing interests (e.g., competition for habitat/resources, tourism, oil and mining companies, hunting groups) (L) [11] SA3.1 conducting research and communicating results to solve a problem (e.g., fish and game management, building permits, mineral rights, land use policies) (L)
Standard E. Science and Technology **A student should understand the relationships among science, technology, and society.**	**The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by:**	[3]SE3.1 listing the positive and negative effects of a single technological development in the local community (e.g., fish trap, fish wheel, four-wheeler, computer) (L) [5] SE3.1 describing the various effects of an innovation (e.g., snow machines, airplanes, immunizations) on the safety, health, and environment of the local community (L) [8] SE3.1 predicting the possible effects of a recent scientific discovery, invention, or scientific breakthrough (L) Standards for grade levels 9-11 do not refer to the local community, but have a local designation [L]

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<table>
<tr><th><u>Standards (Current)</u></th><th colspan="2">Performance Expectations (Current)</th></tr>
<tr><td><u>Standard F. Cultural, Social, Personal Perspectives and Science.</u>
A student should understand the dynamic relationships among scientific, cultural, social, and personal perspectives.</td><td colspan="2">A student who meets the content standard should:
1) develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology;
2) develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world; and
3) develop an understanding of the importance of recording and validating cultural knowledge.</td></tr>
<tr><td></td><td>The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by:</td><td>[3] SF1.1-SF3.1 exploring local or traditional stories that explain a natural event (L) Cross-referenced with SA3.1.
[4] SF1.1-SF3.1 connecting observations of nature to a local or traditional story that explains a natural event (e.g., animal adaptation, weather, rapid changes to Earth's surface) (L) Cross-referenced with SA3.1
[6] SF1.1-SF3.1 telling a local or traditional story that explains a natural event (e.g., animal adaptation, weather, rapid changes to Earth's surface) and relating it to a scientific explanation (L). Cross referenced with SA3.1
[7] SF1.1-SF3.1 investigating the basis of local knowledge (e.g., describing and predicting weather) and sharing that information (L). Cross referenced with SA3.1
[8] SF1.1-SF3.1 describing how local knowledge, culture, and the technologies of various activities (e.g., hunting, fishing, subsistence) influence the development of scientific knowledge (L). Cross referenced with SA3.1
[9] SF1.1-SF3.1 describing the scientific principles involved in a subsistence activity (e.g., hunting, fishing, gardening) (L). Cross referenced with SA3.1.
[10] SF1.1-SF3.1 analyzing the competition for resources by various user groups to describe these interrelationships. Cross referenced with SA3.1.
[11] SF1.1-SF3.1 investigating the influences of societal and/or cultural beliefs on science (L). Cross referenced with SA3.1.</td></tr>
<tr><td><u>G. History and Nature of Science</u>
A student should understand the history and nature of science.</td><td>The student demonstrates an understanding of changes in historical perspectives of science by:</td><td>[9] SG1.1 identifying those perspectives (i.e., cultural, political, religious, philosophical) that have impacted the advancement of science
[10] SG1.1 describing how those perspectives (i.e., cultural, political, religious, philosophical) have impacted the advancement of science.</td></tr>
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Next Generation Science Standards with recommended draft revisions to the Alaska State Science Standards	
Grade Level, Discipline, and Disciplinary Core Idea	**Performance Expectations Students that demonstrate understanding can:**
Middle School Life Sciences Interdependent Relationships in Ecosystems	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **Clarification Statement:** Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources. This emphasis should include local ecosystem processes and traditional native ways of knowing. (MS-LS2-1)
Middle School Physical Sciences **Definitions of Energy**	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. **Clarification Statement:** Examples of devices could include an insulated box, a solar cooker, a Styrofoam cup, or traditional seasonal clothing or dwellings. (MS-PS3-3)
Middle School Earth and Space Sciences **Global Climate Change**	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. Examples of evidence can include tables, graphs, and maps of global and regional temperatures and chemistry (both ocean and land surface), sea ice cover, permafrost, glacial change, atmospheric levels of gases such as carbon dioxide and methane, food availability locally and worldwide, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.] (MS-ESS3-5)

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Excerpt from "All Standards, All Students: Making the Next Generation Science Standards Accessible to All Students," Appendix D of the NGSS Framework:

"There seem to be common themes . . . [for] "equitable learning opportunities" for non-dominant student groups [in the literature]: (1) value and respect the experiences that all students bring from their backgrounds (e.g., homes or communities), (2) articulate students' background knowledge (e.g., cultural or linguistic knowledge) with disciplinary knowledge, and (3) offer sufficient school resources to support student learning."

Effective strategies for students from major racial and ethnic groups fall into the following categories: (1) culturally relevant pedagogy, (2) community involvement and social activism, (3) multiple representation and multimodal experiences, and (4) school support systems including role models and mentors of similar racial or ethnic backgrounds.

Strategies to support economically disadvantaged students include: (1) connecting science education to students' sense of "place" as physical, historical, and sociocultural dimensions, (2) applying students' funds of knowledge and cultural practices, (3) using project-based science learning as a form of connected science, and providing school resources and funding for science instruction.

The NGSS, by emphasizing engineering, recognize contributions of other cultures historically. This (re)defines the epistemology of science or what counts as science, which, in turn, defines or deter-mines school science curriculum. . . . from a pedagogical perspective, engineering has potential to be inclusive of students who have traditionally been marginalized in the science classroom and do not see science as being relevant to their lives or future. By solving problems through engineering in local contexts (e.g., gardening, improving air quality, cleaning water pollution in the community), students gain knowledge of science content, view science as relevant to their lives and future, and engage in science in socially relevant and transformative ways.

Through the NGSS, students can engage in scientific and engineering practices, crosscutting concepts, and disciplinary core ideas by connecting school science to their out-ofschool experiences in home and community contexts. Several approaches build connections between home/community and school science: (1) increase parent involvement in their children's science classroom by encouraging parents' roles as partners in science learning, (2) engage students in defining problems and designing solutions of community projects in their neighborhoods (typically engineering), and (3) focus on science learning in informal environments.

Strategies that involve the community underscore the importance of connecting the school science curriculum to the students' lives and the community in which they live. It is through these connections that students who have traditionally been alienated from science recognize science as relevant to their lives and future, deepen their understanding of science concepts, develop agency in science, and consider careers in science.

Science learning in community contexts may take different approaches. First, both disciplinary and informal education experts underscore the connection between science and the neighborhood that the students reside in. Effective approaches can include engaging in outdoor exploration (e.g., bird surveys, weather journals) and analyzing local natural resources (e.g., land forms in the neighborhood, soil composition).

Second, the community context for science education capitalizes on the community resources and funds of knowledge to make science more culturally, linguistically, and socially relevant for diverse student groups.

Finally, "place-based" science education is consistent with culturally relevant pedagogy. . . . When youth find science education to be empowering and transformative, they are likely to embrace and further investigate what they are learning, instead of being resistant to learning science. Thus, school science should be reconceptualized to give a more central role to students' lived experiences and identities.

Effective implementation of the NGSS for all students, including non-dominant student groups, will require shifts in the education support system. Key components of the support system include teacher preparation and professional development, principal support and leadership, public-private-community partnerships, formal and informal classroom experiences that require considerable coordination among community stakeholders, technological capabilities, network infrastructure, cyber-learning opportunities, access to digital resources, online learning communities, and virtual laboratories

https://ngss.nsta.org/appendix-d-all-standards-making-the-ngss.aspx