Guidance from Educators

Type of Guideline/Guidance	Guideline/Guidance	Source
Characteristics of a Culturally Responsive Science Curriculum	- It begins with topics of cultural significance and involves local experts. - It links science instruction to locally identified topics and to science standards. - It devotes substantial blocks of time and provides ample opportunity for students to develop a deeper understanding of culturally significant knowledge linked to science. - It incorporates teaching practices that are compatible with the cultural context, an focus on student understanding and use of knowledge and skills. - It engages in ongoing authentic assessment which subtly guides instruction and taps deeper cultural and scientific understanding, reasoning and skill development tied to standards.	Stephens 2000[1]
Teaching Strategies & Instructional Practices	Some . . . that most teachers already know have been found effective for all students, regardless of their native language or culture. These are most effective when they are used at developmentally appropriate levels, when students' language proficiencies and cognitive levels are considered, and when instructional materials are culturally responsive and relevant. • **Scaffolding:** Meaningful support and guidance to guide learning growth toward each learning objective. Use of questioning techniques that elicit experiences related to the student's native culture. Use rephrasing with words the student understands and use pictures to adapt the questioning strategy. • **Shelter:** Introduce new concepts by using visual aids, music, or other supports. • **Total Physical Response (TPR):** As much as possible, link language learning (including scientific language] to enable students to make a physical response. • **Reciprocal Teaching:** To help students complete a task, present an interactive activity or lesson, assess student response, and the restructure the activity to guide corrections. Doing this consistently demonstrates how to learn. Giving students tools to control their own learning situation builds self-esteem. • **Critical Thinking Questions:** Encourage students to ask and answer "why" and "how" questions. • **Hands-on Experiences:** Give students opportunities to complete activities that can be demonstrated and describe orally.	Conclusions of a Research Brief in ADEED et. al. 2012[2]

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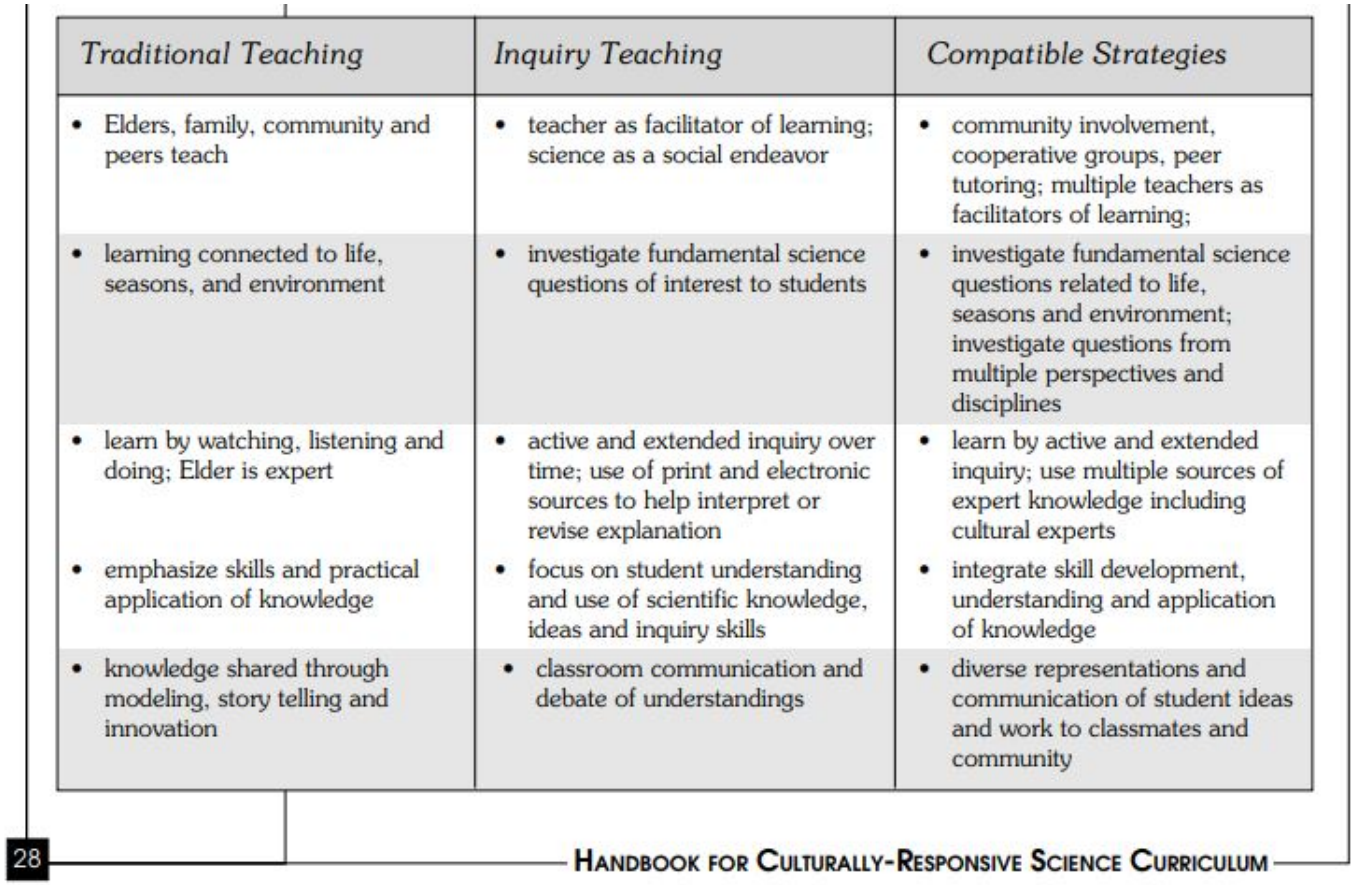
	• **Teaching Techniques:** Simplify instructions and connect the instruction to the students' native culture.	

Best Practices: Traditional Teaching Practices, Inquiry Teaching Practices, and Compatible Strategies



Traditional Teaching	*Inquiry Teaching*	*Compatible Strategies*
• Elders, family, community and peers teach	• teacher as facilitator of learning; science as a social endeavor	• community involvement, cooperative groups, peer tutoring; multiple teachers as facilitators of learning;
• learning connected to life, seasons, and environment	• investigate fundamental science questions of interest to students	• investigate fundamental science questions related to life, seasons and environment; investigate questions from multiple perspectives and disciplines
• learn by watching, listening and doing; Elder is expert	• active and extended inquiry over time; use of print and electronic sources to help interpret or revise explanation	• learn by active and extended inquiry; use multiple sources of expert knowledge including cultural experts
• emphasize skills and practical application of knowledge	• focus on student understanding and use of scientific knowledge, ideas and inquiry skills	• integrate skill development, understanding and application of knowledge
• knowledge shared through modeling, story telling and innovation	• classroom communication and debate of understandings	• diverse representations and communication of student ideas and work to classmates and community

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Themes and Topics of Cultural Significance	Choice of subject matter will be dependent on knowledge that is practical and can be applied to the real world, and the need to know. The application of knowledge is of paramount importance to Native cultures and has traditionally equated to the ability to survive. Plainly said, teach children what they need to know when they need to know it.	Stephens 2000[1]
	Themes: Living in place, Outdoor survival, Applied technology, Energy/ecology Examples of topics: weather prediction, edible and medicinal plants, flora and fauna, moon and tides, celestial navigation, fisheries, subsistence practices, food preservation, outdoor survival	ANKN Spiral Pathway for Integrating Rural Alaska Learning (S.P.I.R.A.L.) Curriculum
	Survival Cultural Survival: traditional foods and dwellngs, weather prediction, ecology (animal movements and biology, plant growth and abundance, birds, insects, water abundance, etc.), health (medicinal plants), community, migration (including migrations of people) Traditional Tools - comparisons with modern technology Fish and wildlife conservation and management, co-management Respect for plants and animals	Garza 2011[3]
Literacy Principles	6D: Arctic indigenous people are important partners to the science community in understanding and observing the Arctic. 6D-1: Native knowledge of Polar Regions contributes to the understanding of natural ecological cycles and the impacts of climate change on the system. 6D-2: Traditional knowledge has proven essential for subsistence harvesting and for sustainable management of natural resources. Other polar literacy principles refer to specific impacts of climate change on indigenous people and coastal communities in the Arctic	Polar Literacy Principles[4]
Citizen Science Projects	1. Make it personal, make it local, make it global. 2. Increase inclusivity in citizen science training 3. Integrate culture, traditional knowledge, and citizen science	Spellman et al. 2018[5]

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Guidance for developing a K-12 STEM education program in a rural, indigenous Alaska community	1. Persistence is key. 2. Face-to-face communication is vital and takes time. 3. A community advocate with influence and respect in the community is critical. 4. Consult with the Elders first. They have their finger on the pulse of the community and are the center of the communication network. Nothing happens without their approval. Find out what it is okay to talk about and where your boundaries are and abide by them. Include funds for honorariums in your proposal. Elders' time and knowledge is valuable and they should be compensated as experts. 5. Partner with individuals or groups, such as the Department of Natural Resources. 6. Find a relevant topic. Be flexible with your curriculum choice. It must reflect the needs and interests of the community and the abilities of the teacher you are working with. 7. Be prepared, bring supplies with you. Ship items in advance if going to a remote location. 8. Have the ability to provide individual instruction for students who need it to prepare projects and practice giving presentations. 9. Involve the community. Hold events in a community center to encourage everyone to attend. 10. View your involvement as a long-term investment in a committed community relationship.	Watts and Smythe 2013[6]

[1]*Handbook for Culturally Responsive Science Curriculum*. Fairbanks, Alaskan Native Knowledge Network. By Sidney Stephens. 2000. http://ankn.uaf.edu/publications/handbook/

[2]*Guide to Implementing the Alaska Cultural Standards for Educators*. Prepared in collaboration with Alaska Department of Education and Early Development (ADEED) by the Alaska Comprehensive Center, Alaska Native Educators, and Education Northwest. 2012. Juneau: ADEED. https://education.alaska.gov/akstandards/cultural/cultural_standards.pdf

[3]*Alaska Native Science: A curriculum guide*. By Dolly Garza. Fairbanks, Alaskan Native Knowledge Network https://seagrant.uaf.edu/bookstore/pubs/M-163.html

[4]Polar Literacy Principles. https://polar-ice.org/polar-literacy-initiative/

[5]Connected Climate Change Learning through Citizen Science: An assessment of priorities and needs of formal and informal educators and community members in Alaska. By Katie V. Spellman, Elena B. Sparrow, Malinda J. Chase, Angela Larsen, and Kelly Keally. 2018. Connected Sci-ence Learning: Linking In-School an Out-of-School STEM Learning. Issue 6. Diversity and Equity. csl.nsta.org/2018/05/connected-climate-change-learning-through-citizen-science/

[6]Incorporating Traditional Knowledge into Geoscience Education. It Takes a Community to Raise a Scientist: A Case for Community-Inspired Re-search and Science Education in an Alaskan Native Community. By Nievita Bueno Watts and Wendy S. Smythe. 2015. CLEARING: A Resource Journal of Environmental and Place. February 23, 2015. http://clearingmagazine.org/archives/1

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