AMERICAN INDIAN CULTURE AND RESEARCH JOURNAL 30:3 (2006) 45–58

Identity, Cultural Values, and American Indians' Perceptions of Science and Technology

KEITH JAMES

OVERVIEW

Scientific and technological expertise are needed to address many of the problems and possibilities faced by American Indian communities and individuals. Indian cultures, traditional knowledge, and Indian individuals' alternative perspectives and unique ideas could aid the advancement of science. Indian access to scientific skills and expertise is insufficient, however, and the potential for Indians to contribute to science is going largely unrealized. This is the case in large part because technological and scientific skill attainment by American Indians has been limited. This article reports results of a study of how Indian students' subjective cultural identities and internalized specific cultural values affect their views of scientific and technological products and professions. The results indicate that strength of subjective identity as an Indian shapes values in such a way as to negatively impact views of science and technology as they are currently practiced. I argue that the basic methods, knowledge, and techniques of science can be taught and applied in many ways, and that alternative approaches to science education and practice can be devised that would increase Indians' scientific achievements and make it more likely that indigenous perspectives would influence scientific research and scientific application.

Keith James (Onondaga) received his PhD from the University of Arizona and is currently professor of psychology and Native studies at Portland State University. Some of the data in this article was collected during the two years he spent at the University of Alaska (Fairbanks campus and statewide system).

CURRENT STATUS OF SCIENCE AND TECHNOLOGY AMONG AMERICAN INDIANS

American Indians are vastly underrepresented in scientific and technological fields. For example, James, Khoo, and Harbold reviewed Indian employment in various science and technology fields.[1] They reported that in virtually every scientific or technical profession, Indian employment falls greatly below its percentage of the total US work force and Indian underrepresentation is greater than that of any other US ethnic group.

Some of this lack of Indian science, mathematics, and advanced technology educational achievement is related to poor general educational success. Credible estimates of the percentage of Indians in the United States who complete high school vary, but there is consensus that Indian students have the lowest graduation rates of any of the major US ethnic groups.[2] High school graduation rates vary considerably across tribes and even those Indian students who do succeed in general education fall below national averages in science and technology knowledge and skill attainment.[3] Yet Indian communities and individuals need some of the skills and knowledge of mainstream science.[4]

Indian communities face substantial economic, environmental, health, and infrastructure problems and opportunities.[5] Effective science and technology education is needed to help address all of those issues. For example, Indian individuals suffer from poor health more than any other group in the United States.[6] Similarly, Indian communities have higher volumes of unaddressed pollution problems than mainstream communities.[7] And communication, waste management, and power provision infrastructures are substantially worse on Indian reservations than in nonreservation areas of North America.[8]

In addition, unemployment is higher and incomes lower among American Indians than among any of the other major ethnic groups in the United States or Canada. It is a fact that science- and technology-related jobs will be the major source of new jobs (especially higher-paying ones) and business for the foreseeable future.[9] So Indian individuals and families will need science and technology knowledge and skills in order to improve their economic well-being and the many other aspects of life that economic success affects.

Finally, the unique knowledge contained within and the distinctive perspectives and thought processes promoted by Indian cultures also might lead to valuable contributions to basic and applied science.[10] For example, the cultural heritage of Indian tribes includes considerable knowledge and understanding of ecological phenomena. Indian peoples evolved their distinctive cultures in close association with the land and other living creatures of North America.[11] This, combined with strategies of careful observation and field experimentation over the course of many generations, has yielded indigenous ecological knowledge that mainstream society has exploited for so long.[12] Even mainstream science has begun to recognize and respect that knowledge recently. Atleo, for instance, describes a collaborative regional ecological management board formed by the mainstream and tribal governments in the Clayoquot Sound region of British Columbia.[13] Inclusion of Indian experts in traditional knowledge, and their perspectives about forests, on that board led

to awareness of a broader range of valuable products (for example, medicinal plants), as well as to timber harvest plans that reduced flooding and erosion.

Indian Cultural Identity

Components of a subjective, internalized sense of Indian identity may be part of the source of difficulty Indian individuals have with science education as it is currently generally organized. Perceptions that science and technology historically have been biased against one's group or are the source of historic damage to that group's culture and well-being are a potential source of self-images among Indians that lead to disidentification with science and technology.[14] From at least the late 1800s through the 1960s, US federal policy was aimed at promoting the full assimilation of Indians into mainstream US society. Efforts were consistently made to break down indigenous cultures and social patterns through, among other things, forced "education" aimed at inculcating the language, values, and behavior patterns of mainstream American society. In essence, the policy in Bureau of Indian Affairs (BIA) boarding schools, mission schools, and other types of schools was to eliminate Indian cultures, communities, and ways of life. Education in the sense of imparting knowledge and skills typically took, at best, second place. Negative views of mainstream education were established among many Indian people that continue to some extent today.[15]

Similar negative effects of cultural identity may also exist for Indian students specific to science education. It has been argued that Indian students often believe that "they cannot do well in science."[16] This perception exists both because Western science has a long history of denigrating indigenous knowledge and beliefs and a history of assisting government or private-sector projects and programs that did substantial harm to Indian people.[17] US and Canadian history reveal instances when science has been intentionally used against Native peoples. In other cases, science has put itself in the service of achieving ends valued by the mainstream culture even when those ends have injured Indian people directly or violated their cultural values.

Similarly, the actions of anthropologists and archaeologists in removing and exploiting the cultural and spiritual materials and remains of Indian ancestors contributed to negative views of mainstream science in particular, as did psychologists and social workers who participated in efforts to break down Indian cultures or who assisted with programs that promoted adoption of Indian children by non-Indian parents. Engineers, chemists, and other scientists supported relatively frequent expropriations of Indian lands for resource extraction, dam building, and other purposes and failed to defend Indians against pollution of their lands and other health-damaging actions, all of which added more support for the impression that science did Indians more harm than good.

Moreover, past group successes or failures in a particular domain of activity are among the elements that contribute to the creation of group identity; individuals also internalize perceptions of group successes/failures into their self-image when they identify with a particular group.[18] Similarly, family,

community, and peer models and messages help to shape beliefs about what skills and careers are possible, interesting, and important.[19] Young Indians, having been exposed to few role models in science and technology, seem less likely than other members of US society to include those possibilities in their sense of self.[20] Internalized identities can also actively militate against success in certain domains when they contain information indicating that one's cultural group has generally poor ability for some discipline or some types of tasks.[21] Many Indian students may have negative views of science and technology because of role modeling and subtle self-image-shaping messages from peers and family, society, and teachers.[22] The direct empirical evidence for that possibility is very limited, however, and developing more and better evidence is the purpose of the research reported in this article.

Cultural Identity, Specific Values, and Indian Science Achievement

Group-derived self-images also incorporate the values that characterize a group. Cultures are largely characterized by patterns of specific values, and the internalization of values into self-images is largely how culture affects individual thinking and behavior.[23] Both Indian peoples and scientists have distinct cultural value patterns, and the patterns for the two groups may contain important incompatibilities.[24]

While there are many specific Indian groups in North America, each of which has a distinctive history, culture, and body of knowledge, many Indian groups also have some general similarities in their overall philosophies about self and world, as well as in their ways of organizing and presenting knowledge.[25] According to some, many Indian cultures share these principles: (1) an equal respect and valuation of nonhuman and human beings; (2) a belief that inevitable bonds exist between the well-being of humans and the well-being of nonhumans; (3) an emphasis on the importance of place and the uniqueness of each locality; (4) a perception that the spiritual and the material are in harmony with each other; (5) a belief that there are multiple ways of knowing, including the scientific and the spiritual, that are equally valuable and equally required for complete understanding; and (6) an orientation toward extended time frames for analyzing phenomena and weighing potential outcomes of actions. [26]

As point five indicates, cultural values shape how Indian people organize, present, and use knowledge, including the types of knowledge that make up mainstream science. Indian organization of knowledge may be relatively integrative. That is, the emphasis may be more on integrating many types of knowledge with each other, as well as on integrating knowledge with spiritual and moral values, than is true in European-derived cultures and systems, including mainstream science. Traditional indigenous worldviews and knowledge systems shun the dichotomies of Western thought: material versus spiritual; scientific versus experiential ways of knowing; and nature versus human. The overall approach taken by Indian people and incorporated into their indigenous knowledge seems to be to integrate ethical, communal, and scientific (knowledge-based) questions and to be more interested in knowledge about the connections

among things than in knowledge only narrowly applicable to one category of things.[27] Moreover, traditionally, knowledge was presented in Indian cultures in the form of metaphorical rituals, stories, or songs; and education was not separated from play, worship, or domestic and economic routines.[28]

Science and technology *education and practice* (if not sciences and technologies) also are tied to certain types of values and behavioral norms. Historically, science education and practice have been and largely continue to be shaped, both overtly and subtly, by a certain set of norms and values that differ from those that characterize traditional Indian cultures. Pacey (an engineer) describes the major values of engineers and scientists based on his review of relevant literature as well as his own analysis.[29] Jackson reports the values of research scientists based on the responses of a large sample to questionnaires.[30] Pacey and Jackson separately came to the same conclusion: scientists are oriented toward mastery of nature, priority to the technically advanced, progress (a better future), independence, and personal prestige and achievement. Science and science education are also inclined toward reductionistic approaches that treat topics and applied issues in isolation from each other.[31] It has been proposed that because these values that underlie science education and practice differ in many ways from those of Indian cultures, Indian students, their families, and their communities often see science and technology and success in science and technology education as antithetical to their identities as Indian people.[32]

Value differences can also promote intergroup tensions that can help disrupt minority success. For instance, Sanders argued that incompatibility between American Indian cultural values and norms and those held by Euro-American teachers or classmates produces isolation, conflict, and stress, and that these are major causes of academic failures among American Indian students.[33] The direct empirical evidence for this is not strong. There is better evidence of the operation of the same process among other groups. For instance, Subtonik and Steiner's longitudinal study of scientifically precocious adolescents found that felt sociocultural isolation and perceived scientific reductionism were important factors in the attrition of talented white females from scientific training.[34]

In summary, Indian cultures have been argued to yield a distinctive pattern of specific values and behavioral/self-image norms. This and the unique ways of organizing and presenting knowledge that Indian cultural principles promote have been argued to make for a difficult fit with mainstream science and its traditional philosophical emphasis on reductionism, fragmentation across disciplines, individualism and competitiveness, and abstract methods of information organization and presentation.

The Current Study

Based on the preceding discussion, it seemed reasonable to expect that stronger cultural identification with Indian heritage and culture might be associated with more negative views of science and advanced technology among Indian youth. On the other hand, stronger identification with

mainstream (Anglo- or Euro-American) society and culture might promote more positive views of science and advanced technology.

Anglo-American cultural identity should be more likely among white youth but also exists to some extent among many Indian adolescents because they are constantly exposed to mainstream society in school, through the media, and in their day-to-day interactions. The model guiding this study is that Indian students can identify with both an Indian tribe/culture *and* with mainstream US society at the same time. It seems reasonable that stronger Indian identities among Indian students may predispose them to some negative views of mainstream science as it has historically been and currently is practiced and presented. However, relatively high Anglo-American cultural identities among Indian students may predispose them toward more positive views of science and advanced technology.

There is, however, very little direct quantitative research on the effects of sociocultural identity on the values and norms of Indian students or on the relation of specific Indian cultural values and norms to their views of science and advanced technology. The current study, therefore, is intended to produce additional empirical evidence of the relation of culture to beliefs about and attitudes toward science and advanced technology among American Indian students. In the data presented here, I investigated how variations in Indian students' degrees of identification with Indian communities and Indian cultures versus the US mainstream society and culture help shape four specific culture values that the literature reviewed in the preceding text shows may differ between many scientists and many American Indian people. The cultural values were, in turn, examined for relations to various specific types of views of science and technology as assessed by a previously validated inventory.

METHOD

Participants

The participants were 196 students at tribal colleges, urban high schools in Colorado, and reservation high schools in South Dakota and Washington State. The college and urban high school students completed the study materials in classrooms at the tribal colleges during the academic year. The reservation high school students completed the materials in classrooms during a summer academic enrichment program run by a tribal education department. Almost all reservation high school students attended schools run by tribal governments. A few of the participants attended off-reservation public or private schools. Students were paid $10 to participate in the study.

Predictors

Cultural identification was operationalized using the six-item American Indian Identity and the six-item Anglo/White Identity subscales of the Oetting-Beauvais Cultural Identity Inventory (CII). There is substantial

evidence for the reliability and validity of this inventory.[35] One sample item is: "Some families have special activities or traditions that take place every year at particular times. . . . How many of these special activities or traditions does your family have that are based on American-Indian culture?" Each item is rated for applicability to the respondent on a four-point scale anchored by "none at all" or "not at all" and "a lot." Each participant received two cultural identity scores: one for the strength of Indian cultural identity and one for the strength of Anglo-American cultural identity.

Theoretically, according to Oetting and Beauvais, scores for Anglo-American and Indian identification are independent of each other. That is, a given individual can potentially be high on both, low on both, or high on one and low on the other. This is an antiassimilationist model in that Anglo-American and Indian identities are not pitted against each other as polar opposites; rather, they are seen as orthogonal (separate) dimensions of the complex overall identity of each person. In Oetting and Beauvais's validation studies, as well as in a study by James, Chavez, Edwards, Beauvais, and Oetting in which almost 800 Indian students completed the CII, the majority of Indian students were found to have some degree of Anglo-American identity.[36] Moreover, in the studies just mentioned, the Indian Identity and Anglo Identity scores from the CII had unique relations to outcome variables such as achievement in school, dropping out of school, and levels of substance abuse.

Four specific cultural values were assessed using scales created by the current author based on items developed and validated by Kluckhohn.[37] It is labeled the "Kluckhohn Inventory" in the results section and yields scores for degree of orientation toward mastery over nature; time orientation (toward the future or the past); individualism; and view of human nature (that is, generally positive or generally negative).

Attitudes and beliefs about science and technology were assessed using a Cognitions and Beliefs about Technology and Science (CABATS) inventory that was developed by the current author. Eight categories were identified through a literature search and substantiated by a Q-sort—a sorting of a large group of items into categories that they seem to fit under—done by two subject-matter experts. Items were written by a team of faculty members and PhD students and polished and supplemented by undergraduate and PhD students in undergraduate- and graduate-level test and measurement classes. A Confirmatory Factor Analysis (CFA) was used to substantiate the eight factors and the items that compose each one. It has been validated with American Indian/Alaska Native participants and members of the other four major US ethnic groups.[38] It yields scores for eight subscales of categories (factors) of beliefs about and attitudes toward science and advanced technology: (1) *traditionalism* consists of items focusing on whether or not the traditional cultural values of one's family and group are seen as incompatible with science and advanced technology; (2) *self-image* consists of a set of items reflecting the belief that those who develop and use advanced technology and science share important characteristics (for example, age, ethnicity, and gender) with the respondent; (3) *social damage* includes items assessing beliefs that science and technology damage interpersonal and community relationships and community health; (4) *environmental*

damage consists of items that assess perceptions that technology damages the physical environment; (5) *intellectually/spiritually positive* contains items that refer to the effects of science and technology on individual growth and development; (6) *science/technology heroic* is intended to assess perceptions that science and advanced technologies bring status and prestige to the individuals who master them; (7) this category is comprised of items that reflect perceptions of *enhanced control/power* from science and technology; and (8) *economic advantage* examines strength of belief in the economic and competitive benefits brought by science and advanced technology.

RESULTS

Linear structural modeling would be the ideal analysis strategy for the constructs and measures employed. The number of participants involved in this study was too low to yield dependable results from structural modeling programs, however. Therefore, I simply examined the pattern of bivariate correlations among the identity, value, and technology perception variables. The separate Anglo- and Indian-Identity scores were each correlated with the four specific cultural values assessed by the Kluckhohn Inventory. Those four cultural values were then correlated with the scores for the subscales of the Beliefs about Technology Inventory. The significant correlations that resulted are shown in figure 1.

DISCUSSION

The pattern of correlations shown in figure 1 generally substantiated the argument that having a strong subjective Indian cultural identity has negative implications for perceptions of science and advanced technology. The results were complex, however, for both Indian Identity and Anglo Identity, with the latter yielding mixed results relative to perceptions of science and technology.

Indian Identity had a significant negative correlation and Anglo Identity had a significant positive correlation with individualism. Individualism, in turn, correlated negatively with the extent of the belief that advanced technology causes social and environmental damage and correlated positively with the extent of the belief that technology is heroic. Thus, having a relatively strong Indian Identity tended to reduce adherence to a cultural value (individualism) that promotes positive views (that is, they are heroic and do not generally promote social or environmental damage) of science and technology. Indian Identity also had a significant negative correlation with the valuing of mastery over nature, and orientation toward mastery over nature was associated with lower perceived environmental damage from technology, as well as with higher perceived levels of heroism associated with technological skill. Thus, by way of its negative relations with both individualism and mastery over nature as values, Indian Identity was related to greater perceived damage (social and environmental) from technology and lower perceived heroism from mastery of advanced technologies. On the other hand, by way of individualism, Anglo Identity was associated with

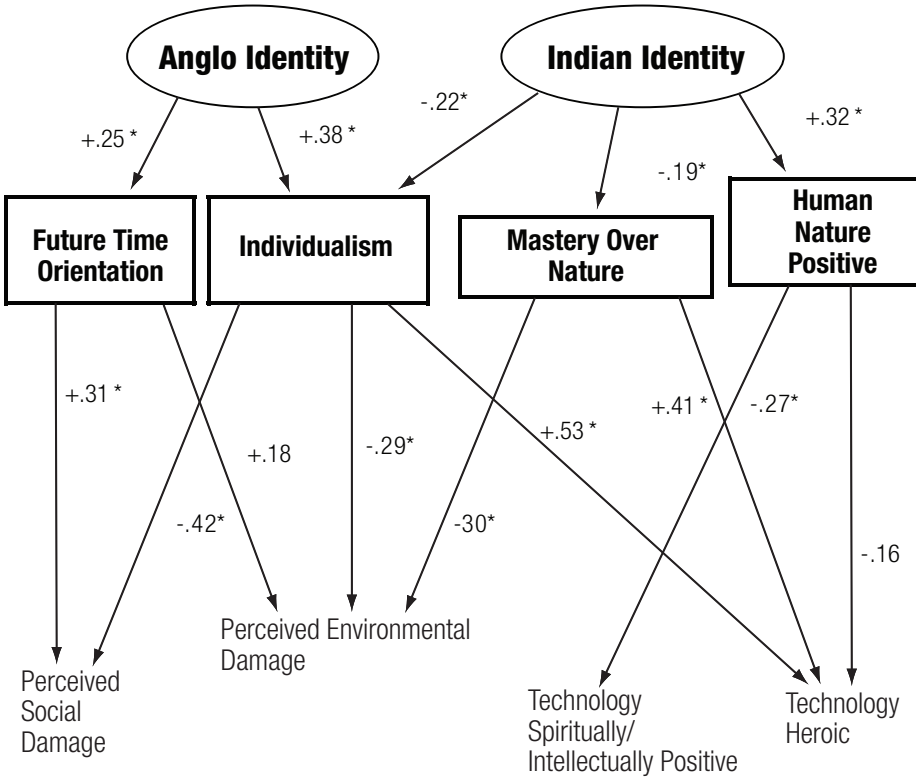

Figure 1. *Relations of Anglo and Indian identities to cultural values and of values views of science and technology.*

lower perceived damage from technology and higher perceived heroism to it. Anglo Identity also correlated significantly and positively with Future Time Orientation (FTO) as a value, and FTO correlated significantly and positively with perceptions that advanced technology damages the environment and society. Thus, by way of a positive association with individualism as a value, Anglo Identity was indirectly related to viewing science and advanced technology positively in this sample. Through its positive connection with FTO, Anglo Identity was linked to a value that was associated with negative views of science and advanced technology.

In future studies, it would be interesting to see whether Anglo Identity has the same type of both positive and negative implications for views of technology among Anglo students, or whether it is something unique to Indian students' partial identification with mainstream society that created the pattern for Anglo Identity reported here. Similarly, because some Anglo students have been found to receive nonzero scores for Indian Identity in the past, it would be interesting to see if the pattern of relations reported here

between variation in self-reported Indian Identity and values and between values and views of technology would hold for a sample of Anglo students.

The current results point toward how internalized identity relates to values and how values help shape views of science and technology. In future studies, I hope to study different methods of organizing and presenting science and technology information and how different social contexts interact with identity to influence interest in and ability to master science and advanced technologies. For example, it has been suggested that group-based and cooperative forms of education may be more effective for American Indian students than the individualistic/competitive approaches that often characterize mainstream education. Similarly, educational programs that thoroughly integrate mainstream science and traditional Indian cultural knowledge and perspectives should help students with strong Indian identities develop knowledge systems and skill sets that are congruent with both mainstream and Indian perspectives.

While there are numerous programs established to recruit minorities and women into scientific fields, they have limited effects on increasing the numbers of Indian students majoring in or receiving undergraduate or graduate degrees in science or engineering.[39] One reason for this lack of representation seems to be that Indian students sometimes see science as incompatible with being an American Indian. Given this, it is not surprising that integrating Indian perspectives and knowledge with mainstream science has been indicated, in a few available examples, to be an effective approach to increasing the numbers of Indian individuals succeeding in training as scientists and technicians.[40]

Similarly, one study has produced evidence that emphasizing the collective benefits of a specific type of science and technology (photovoltaic solar cells) promoted learning among people who score higher on collectivism, while emphasis on personal benefits promoted learning among people who score higher in individualism.[41] Thus, we may be better able to design curricula and programs that fit with Indian Identity as a mental and cultural system with greater understanding of how various specific values impact reactions to science and technology.

Finally, how the identity components of values and beliefs are organized in people's minds has been shown to directly impact the activation of knowledge and skills needed to perform successfully on tasks that are stereotypically linked (or not linked) to particular social groups. In addition, different social contexts can activate different identities and different specific components of any given identity. Any one of the four values assessed here could, for example, be more active (influential, mentally and behaviorally dominant) than the other three because of its links to a specific identity that has been activated by immediate circumstances. Similarly, in the unlikely event that all four values were equally strongly tied to a particular active identity, specific situational features (objects, events, ideas) can still implicate one value more than the others such that the one would exert more influence on thinking and behavior than any or all of the others. For instance, Steele has shown that social contexts that activate African-American students' beliefs about their own racial group can suppress their performance on tests of academic skill and knowledge.[42] Similarly, James and Greenberg have shown that contexts

that help activate internalized social stereotypes about female/male differences in ability regarding specific tasks influence the level of ability that individuals display on gender-linked tasks.[43] In the future, I hope to examine how variations in social context across communities, educational institutions, courses, and instructor/student relationships might influence both the nature and the activation of particular identities and components of identities such that science and technology interests and apparent aptitude are affected. For instance, can integrating components of mainstream science with traditional Native knowledge and presenting information about Native science role models alter the perceived relationship of Indian identity to science?

Note that it is not at all my intent to imply that Indian students need to assimilate into mainstream culture and abandon their Native cultures in order to succeed in science. Native people always practiced a form of science by learning through observing—for example, climatic patterns and star movements—and systematically manipulating plants, chemicals, and other aspects of their environment to discover and create ways of meeting their needs.[44] If modern science seems to some Indian students not to fit with Indian identity, the fault is with science and mainstream society, not with Indian students. Mainstream science is characterized by its own culture that is linked to identity as a scientist. Just as the identity of Indian students can affect their perceptions of science, the identities of mainstream scientists and the values associated with them can affect their choices as educators and researchers and their interactions with Indian students or Indian cultures. Identity issues can also make it difficult for mainstream scientists to recognize the existence or the quality of traditional knowledge. The implications of the identities of scientists for their educational approaches, their scientific research and practice, and the application of science to Native community issues are, therefore, also areas ripe for future study.

Recently, even some non-Indian scientists have begun recognizing the potential value of integrating Indian traditional knowledge and perspectives with mainstream science. Interest in indigenous knowledge has produced conferences, National Science Foundation and other support for research and educational projects, and various publications on indigenous knowledge. Moreover, some recent trends in mainstream environmental science, such as increased interest in complexity theory and the resource management models based on it, potentially fit well with traditional Indian values. It would be interesting to study how those new trends in science are perceived by Indian students, how they affect approaches to science education and the success of Native students, and whether they could be used as the basis for creating a true synthesis of science and American Indian culture.

Clearly the study outlined in this article is only preliminary and heuristic. While the results are interesting in and of themselves, they also point toward vast additional work that needs to be done on the relations among identity, values, and the manifest needs both to increase the success of Indian people in modern science and to reshape mainstream science research, education, and application toward approaches more likely to sustain the earth and all of its peoples.

NOTES

1. Keith James, Gillian Khoo, and Diane Harbold, "Minority Women and Technology," *Technology Studies* 3 (1996): 94–120.

2. Commission on Professionals in Science and Technology, *The Status of Native Americans in Science and Engineering* (Washington, DC: Commission on Professionals in Science and Technology, 2005).

3. Commission on Professionals in Science and Technology, *The Status of Native Americans* and Keith James "American Indians, Science, and Technology," *Social Science Computer Review* 18 (2000): 196–213.

4. Ibid.

5. Assembly of First Nations, *Restoring First Nation Governments* (Ottawa, Canada: Assembly of First Nations, 2000) and James, "American Indians, Science."

6. T. K. Young, *The Health of Native Americans: Toward a Biocultural Epidemiology* (New York: Oxford University Press, 1994).

7. Freda Porter-Locklear, "Water and Water Quality Issues in and for American Indian Communities," in *Science and Native American Communities: Legacies of Pain, Visions of Promise,* ed. Keith James (Lincoln: University of Nebraska Press, 2001), 111–18.

8. National Telecommunications and Information Administration, *Falling through the Net: Defining the Digital Divide. A Report on the Telecommunications and Information Technology Gap in America* (Washington, DC: US Department of Commerce, 1999) and Assembly of First Nations, *Banishing the Indian Agent, Choices for Change* (Ottawa, Canada: Assembly of First Nations, 2000).

9. Ibid.; Office of Technology Policy, *The Digital Work Force: Building Infotech Skills at the Speed of Innovation* (Washington, DC: US Department of Commerce, 1999) and Keith James, Willie Wolf, Christofer Lovato, and Steve Byers, *Barriers to Workplace Advancement Experienced by Native Americans* (Washington, DC: US Department of Labor, Glass Ceiling Commission Monograph Series, 1995).

10. Gregory Cajete, *Native Science: Natural Laws of Interdependence* (Santa Fe, NM: Clear Light Publishers, 2000); James, "American Indians, Science"; and David D. Suzuki and P. Knudtson, *Wisdom of the Elders: Sacred Native Stories of Nature* (New York: Bantam Books, 1992).

11. Cajete, *Native Science*; Donald L. Fixico, *The American Indian Mind in a Linear World* (New York: Routledge, 2003); and Jake Weatherford, *Indian Givers: How the Indians of the Americas Transformed the World* (New York: Fawcett, 1988).

12. R. O. Stephenson, "Nunamiut Eskimos, Wildlife Biologists, and Wolves," in *Wolves of the World,* ed. F. H. Harrington and P. C. Pacquet (Park Ridge, NJ: Noyes Publications, 1982), 434–39 and Weatherford, *Indian Givers.*

13. Ibid.

14. Clifford Atleo, "Land, Science, and Indigenous Science: Tales from a Modern Treaty Negotiation Process," in James, *Science and Native American Communities,* 155–63.

15. Fixico, *American Indian Mind*; James, "American Indians, Science"; and W. Rybczynski, *Taming the Tiger: The Struggle for Control of Technology* (New York: Viking, 1983).

16. Frank Dukepoo, "The Native American Honor Society: Challenging Indian Students to Achieve," in James, *Science and Native American Communities,* 36–42.

17. R. Common and L. Frost, *Teaching Wigwams: A Model Vision of Native Education* (Muncey, Ontario, Canada: Anishinaabe Kendaaswin Publishing, 1994) and J. Lipka and T. L. McCarty, "Changing the Culture of Schooling: Navajo and Yup'ik Cases," *Anthropology and Education Quarterly* 25 (1994): 266–84.

18. James, "American Indians, Science" and Suzuki and Knudtson, *Wisdom of the Elders*.

19. James, "American Indians, Science"; J. P. Pommersheim and F. H. Bell, "Computer Programming Achievement, Cognitive Style and Cognitive Profiles," *ADES Journal* 15 (1986): 51–59; and R. B. Slaney and J. E. A. Russell, "Perspectives on Vocational Behavior, 1986: A Review," *Journal of Vocational Behavior* 31 (1987): 111–73.

20. Dukepoo, "Native American Honor Society."

21. E.g., Keith James and Jeff Greenberg, "Spatial Test Performance among Women: Social Context Influences on Individual Ability," *Basic and Applied Social Psychology* 19 (1997): 411–25 and C. M. Steele, "A Threat in the Air: How Stereotypes Shape Intellectual Identity and Performance," *American Psychologist* 52 (1997): 613–29.

22. Dukepoo, "Native American Honor Society" and James "American Indians, Science."

23. Francis R. Kluckhohn and F. L. Strodbeck, *Variations in Value Orientations* (New York: Harper and Row, 1961) and Harry C. Triandis, "The Self and Social Behavior in Differing Cultural Contexts," *Psychological Review* 96 (1989): 506–20.

24. James, *Science and Native American Communities*.

25. Vine Deloria Jr., *Red Earth, White Lies: Native Americans and the Myth of Scientific Fact* (Golden, CO: Fulcrum Press, 1997) and James, "American Indians, Science."

26. Ibid.; Cajete, *Native Science*; Fixico, *American Indian Mind*; Arnold Pacey, *The Culture of Technology* (Cambridge: Cambridge University Press, 1983); and Joseph E. Trimble, "Value Differences among American Indians: Concerns for the Concerned Counselor," in *Counseling across Cultures,* ed. P. Pedersen, W. J. Lonner, and J. G. Draguns (Honolulu: University of Hawaii Press, 1976), 65–81.

27. E. N. Anderson, *Ecologies of the Heart: Emotion, Belief, and the Environment* (New York: Oxford University Press, 1996); Cajete, *Native Science*; Fixico, *American Indian Mind*; and R. A. Rappaport, "The Sacred in Human Evolution," *Annual Review Ecology and Systems* (1971): 23–44.

28. M. Bopp, G. Fritz, D. McNeil, P. Lucas-Morris, G. Strikes-With-A-Gun, P. Strikes-With-A-Gun, S. Waboose, and E. L. Warrior, "How We Used to Work," *The Four Worlds Exchange* (1989): 18–20.

29. Pacey, *Culture of Technology*.

30. Daniel N. Jackson. "Scientific and Technological Innovation: Its Personological and Motivational Context," in *Scientific Excellence: Origins and Assessment*, ed. Daniel N. Jackson and J. P. Rushton (Newbury Park, CA: Sage, 1987), 149–64.

31. Pacey, *Culture of Technology* and R. F. Subotnik and C. L. Steiner, "Adult Manifestations of Adolescent Talent in Science: A Longitudinal Study of 1983 Westinghouse Science Talent Search Winners," in *Beyond Terman: Contemporary Longitudinal Studies of Giftedness and Talent*, ed. R. F. Subotnik and K. D. Arnold (Norwood, NJ: Ablex, 1994), 52–76.

32. Dukepoo, "Native American Honor Society"; James, "American Indians, Science"; and D. Sanders, "Cultural Conflicts: An Important Factor in the Academic

Failure of American Indian Students," *Journal of Multicultural Counseling and Development* 15 (1987): 81–90.

33. Ibid.

34. Subotnik and Steiner, "Adult Manifestations."

35. Eugene R. Oetting and Fred Beauvais, "Orthogonal Cultural Identification Theory: The Cultural Identification of Minority Adolescents," *International Journal of the Addictions* 25 (1990): 655–85 and Eugene R. Oetting, Randolf C. Swaim, and Margarita C. Chiarella, "Factor Structure and Invariance of the Orthogonal Cultural Identification Scale among American Indian and Mexican American Youth," *Hispanic Journal of Behavioral Sciences* 20 (1998): 131–54.

36. Keith James, Ernest Chavez, Fredrick Beauvais, Ruth Edwards, and Eugene R. Oetting, "School Achievement and Dropout among Anglo and Indian Females and Males," *American Indian Culture and Research Journal* 19 (1995): 181–206.

37. Francis R. Kluckhohn, "Dominant and Variant Value Orientations," in *Personality in Nature, Society, and Culture*, ed. Francis R. Kluckhohn and H. A. Murray (New York: Knopf, 1953) and Kluckhohn and Strodbeck, *Variations in Value*.

38. Keith James and Joseph Cardador, "Cognitions and Beliefs about Technology and Science: Measurement, Validation, and Application to Career Choice Decisions," *Journal of Career Assessment* (in press).

39. Commission on Professionals in Science and Technology, *The Status of Native Americans*.

40. E.g., Common and Frost, *Teaching Wigwams* and Lipka and McCarty, "Changing the Culture."

41. Keith James, "Perceived Self-Relevance of Technology as an Influence on Attitudes and Information Retention," *Journal of Applied Behavioral Science* 29 (1993): 56–75.

42. Steele, "A Threat in the Air."

43. James and Greenberg, "Spatial Test."

44. Cajete, *Native Science*; Fixico, *American Indian Mind*; and Weatherford, *Indian Givers*.