

LEARNING PATTERNS AND EDUCATION OF ABORIGINAL CHILDREN: A REVIEW OF THE LITERATURE

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Abstract / Résumé

In this article we review literature on learning and cognitive patterns of Aboriginal individuals including visual-spatial abilities, holistic learning, learning styles, hemisphere dominance, and field dependence. We then focus on instruction of Aboriginal children by reviewing literature on different teaching techniques, including interactive, creative and experimental teaching, as well as the use of visual aids, whole language teaching, and community involvement. Culturally responsive teaching and testing issues are also addressed.

Le présent article présente un aperçu général de la documentation sur l'apprentissage et les structures cognitives des Autochtones, y compris les aptitudes oculo-spatiales, l'apprentissage intégré, les styles d'apprentissage, la dominance d'un hémisphère du cerveau et la dépendance du champ. Les auteures mettent ensuite l'accent sur l'instruction des enfants autochtones en examinant la documentation sur diverses techniques d'enseignement, y compris l'enseignement interactif, créatif et expérimental, l'utilisation des aides visuelles et de la méthode analytique et la participation communautaire. L'article aborde également les questions de l'enseignement et de l'administration de tests adaptés à la culture autochtone.

Learning Patterns and Education of Aboriginal Children: A Review of the Literature

Aboriginal individuals display unique learning and cognitive patterns as compared to Caucasian individuals and, as a result, special educational recommendations have been proposed for teaching Aboriginal children. School systems, however, typically use instructional methods consistent with patterns that apply to the dominant culture. This discrepancy may lead to an incompatibility between the patterns of learning among Aboriginal children and the ways in which they are instructed. In this article we review the learning patterns, styles, and preferences, and education of Aboriginal individuals. We highlight the distinct learning patterns of Aboriginal children and illustrate how these learning patterns may not always be addressed in typical curricula. First we review research and literature on visual-spatial abilities, holistic learning, learning styles, hemisphere dominance, and field dependence among Aboriginal individuals. We then focus on instruction of Aboriginal children including culturally responsive teaching and testing issues.

Learning and Cognitive Patterns

Visual-Spatial Abilities

Aboriginal individuals demonstrate strengths in visual-spatial abilities. Berry (1966) administered various visual-spatial tests to Canadian Inuit and two comparison groups: the Temne of Sierra Leone, and Scottish individuals, aged 10 to over 40 years. The Inuit sample performed much higher than both groups on a test of visual discrimination and the Temne group performed the lowest, despite equivalent visual acuity among the groups. On tests of spatial skill, the Inuit performed substantially higher than the Temne and generally at the same level as the Scottish. Furthermore, among both the Inuit and Temne, the transitional groups who had more contact with Western culture and education performed better on spatial measures than the traditional groups. The Inuit sample was considered to have well-developed visual spatial abilities. Kleinfeld (1971) found that Inuit children performed significantly higher than Caucasian children on a test of visual memory. These spatial abilities among the Inuit and Canadian Natives are thought to serve as a cluster of abilities that are highly interrelated (MacArthur, 1968; MacArthur, 1973).

Kleinfeld (1973) reviewed research suggesting that the demands of the arctic environment might be a factor contributing to the well-developed visual-spatial abilities of Inuit individuals. In particular, the author described the Arctic hunting environment as very flat and plain with

very minor visual cues, and the Inuit must be able to detect slight changes in the snow atmosphere. They also have to scan and remember visual-spatial information to navigate in their environment with very few landmarks. The author suggested that individuals with strong visual-spatial abilities would have a better chance of surviving the environment and passing along the advantageous traits. Kleinfeld also reviewed anecdotal evidence indicating that Inuit individuals are able to successfully view maps and objects from various angles of rotation and draw highly detailed and accurate maps of vast areas of land. Likewise, Berry (1971) proposed that spatial perceptual development is related to ecological environmental demands and that the environmental demands of some hunting groups support well-developed visual-spatial abilities. Similarly, Berry and Annis (1974) reported high levels of perceptual differentiation among some Aboriginal hunting groups.

MacArthur (1975, 1978) concluded that Canadian Inuit children, adolescents, and adults have strengths in spatial field-independence because on these tasks they performed at the level of Caucasians but performed far below Caucasians on verbal-educational tasks. Interestingly, and contrary to Berry's (1966) finding that performance on verbal tasks was positively related to transition to Western society, spatial field-independence was not related to transition. In another study, MacArthur (1969) found that among Canadian Inuit, Métis, and Caucasians, nonverbal reasoning factors were least related to ethnic group whereas verbal factors were most related.

Taylor and Skanes (1976), however, found no differences between Canadian Inuit and Caucasian Grade 1 children on spatial, verbal, and inductive reasoning tasks when matched for socio-economic status. On examination of the means, however, it is evident that the results are in the predicted direction, although non significant. For instance, Inuit children performed somewhat higher than the Caucasian average on the test of spatial ability, and lower than the Caucasian average on vocabulary and to a lesser extent arithmetic (both are verbal measures).

In a review of the research on visual-spatial abilities of the Inuit, Kleinfeld (1973) concluded that, in general, Inuit individuals tend to perform higher than Caucasians on tests of visual-spatial ability, when the educational level of the Inuit is lower than Caucasians, however, the Inuit tend to perform at the same level or slightly lower than Caucasians. Kleinfeld also pointed out that almost all the research in this area has been conducted with standardized tests, normed with Caucasian individuals, and that some Inuit may be unfamiliar with test-taking procedures including test items and timing. Language barriers and cultural

biases may also affect performance.

Others have found similar results of superior visual-spatial abilities among Aboriginal children. Vernon (1966) reported well-developed visual spatial abilities among Canadian Inuit and Native children. Lombardi (1970) examined performance of Papago Native American children on measures of psycholinguistic ability. The author found that their performance was highest on visual memory relative to other measures and that visual memory was the only test in which they performed higher than the Caucasian standardized sample. Performance among the Papago children was lowest on the auditory-vocal subtest, perhaps because they were less proficient in English. Likewise, Garber (1968) as cited in Kirk (1972), found that Native American children performed higher on visual memory as compared to other measures of psycholinguistic ability. Using an observation method, Guilmet (1981) found that Navajo students attended to teachers in more nonverbal and visual manner than Caucasian children who used a verbal-linguistic approach.

In a similar view, Dasen (1975) found that Canadian Inuit and Australian Aboriginal children can successfully complete spatial tasks at a younger age than African children. In two experiments, Kearins (1986) compared Australian Aboriginal adolescents and children who were from both tradition and semi-traditional groups to a control group of Caucasian individuals on tests of visual-spatial memory. The findings were striking: The Aboriginal children from traditional and semi-traditional backgrounds, as well as the Aboriginal adolescents, performed significantly higher than the Caucasian samples on all measures of visual-spatial memory. Furthermore, in a series of experiments, Kearins (1981) again found that Aboriginal adolescents performed significantly higher than Caucasians on all measures of visual-spatial memory. In these experiments, children had to memorize the location of particular objects. The Aboriginal sample performed consistently higher than the Caucasians regardless of whether the objects were natural (e.g. rocks) or man-made (e.g. eraser) and whether the objects were similar or dissimilar. Furthermore, Aboriginals used largely nonverbal approaches (they were usually very still and silent when answering) whereas some Caucasians appeared to use verbal approaches (they pointed to objects and whispered). Also, items that were familiar and nameable were easier than unfamiliar items for the Caucasians but not for the Aboriginals, perhaps because the Caucasian sample used verbal strategy (Kearins, 1981). The superior Aboriginal performance held true for traditional, semi-traditional, and even nontraditional Aboriginals.

Another aspect of cognition that has been frequently studied in Aboriginal populations is IQ, based on the Wechsler Intelligence Scale

for Children (WISC). It has been consistently found that Native American children perform higher on performance IQ than on verbal IQ (for a review see McShane 1980 and Vraniak, 1994; Beiser & Gotowiec, 2000). Performance IQ measures perceptual organization, visual spatial abilities, visual-motor dexterity, attention, and processing speed. Verbal IQ measures verbal comprehension, vocabulary, arithmetic, working memory and freedom from distractibility. Thus, researchers have suggested that this pattern of performance indicates that Native Americans have higher visual-spatial than verbal abilities (Deissner & Walker, 1989; McShane, & Plas, 1982).

In literature reviews, other researchers have commented on the findings that Aboriginal individuals have well developed or higher visual-spatial than verbal abilities (Kaulback, 1984; McShane & Berry, 1988; More, 1989; Osborne, 1985; Pepper & Henry, 1986; Ryan, 1992). More (1989) reviewed studies examining Native American learning styles, which indicated that some Native Americans have strengths in global, simultaneous, and visual-spatial processing, as well as in the use of imagery for coding. Taken together, the research presented indicates that some Aboriginals (Inuit, Australian, Native American and Canadian) have strengths in visual-spatial abilities, particularly in comparison to their verbal abilities. There are some inconsistencies, however, as some researchers have found these visual-spatial abilities to be higher than those of Caucasian groups, yet others have found the visual-spatial abilities of Aboriginals to be the same as Caucasian groups but their verbal abilities to be much lower than those of Caucasians. Thus, these two findings have different implications as the former implies strengths in visual-spatial abilities, but the latter can be interpreted simply as a weakness in verbal abilities. It is also important to note that the bulk of the visual-spatial memory research has been conducted with Inuit and Australian samples, and to a lesser extent with Native American and Canadian individuals. However, a lot of the IQ research, which implicates strengths in visual-spatial processing, has been conducted with Native Americans.

The majority of the empirical research presented is not contemporary. More recent research would be useful to determine whether these strengths and differences still exist, and if so, how strong they are. For instance, researchers (Berry, 1971; Kleinfeld, 1973) have suggested that their superior visual-spatial abilities of the Inuit were in part due to adaptations and ecological demands of their environment, but with numerous technological advances perhaps these abilities may be less critical to survive their environment. Also, in the cases where visual spatial abilities are compared to verbal abilities, strengths were noted

because the verbal abilities were much lower. However, lower verbal abilities may also be due to a lower English language proficiency among the Native samples, as many Native American groups, particularly in the 1970s and 1980s were bilingual with English as a second language. Thus, these strengths in visual-spatial abilities can also be interpreted as weaknesses in verbal abilities. This interpretation is also complicated by the fact that verbal tests may be more subject to cultural biases than performance tests, whereas visual spatial tests are thought to be more universal and less subject to cultural biases.

Holistic and Observational Learning

Aboriginal individuals have been described as holistic learners, perceiving the world as a whole, as opposed to breaking the whole into pieces (Ryan, 1992). The holistic learning approach is also more visual, whereas the opposing analytical approach is more verbal. Tharp (1994) suggested that Native Americans have a holistic cognitive style, in which the whole is used to determine the meaning of the parts, rather than the analytic approach, in which the parts are used to learn about the whole, as with most Caucasian individuals. Native Americans are also described as observational learners (Tharp, 1994).

In a similar view, Pepper and Henry (1986) recommended a holistic approach to Native classroom learning that accounts for the child's inner and outer environment. Native values of sharing, cooperation, group work, and harmony are seen to influence learning. The authors described Native children as observational learners who rely more on visual information than on verbal or auditory information, as in typical instruction. Furthermore, Native children were described as holistic, group-oriented, and community focused learners. Christie and Harris (1985) described Australian Aboriginals as observational, experiential, and holistic learners, in addition to being less verbal. Observational learning is also preferred among Native American adults (Sawyer & Rodriguez, 1993).

Arbess (1981) highlighted differences between Native Canadian children and typical school factors. He defined most teachers as authoritarian, promoting individual effort work, while Native children are more egalitarian and do well at collaborative work. In addition, most typical classrooms are defined as competitive, and emphasize performance, while Native children are more cooperative and peer oriented. Lastly, Native children are described as holistic learners, whereas most schools promote linear sequence learning.

The previous suggestions are very interesting, but they are largely based on anecdotal and descriptive evidence. These descriptions can

be useful for qualifying and describing, but experimental research would also be beneficial to further validate the claims. Hence, experimental research on whether or not Aboriginal individuals approach tasks and learn in a holistic manner would be valuable, as well, whether holistic teaching techniques actually enhance academic efficacy among Aboriginal students.

Learning Style Preferences

Aboriginal individuals appear to display some unique learning styles. Learning styles reflect how students approach different tasks (Smith & Shade, 1997) and, more specifically, their preferences for perceiving and assessing information (Simmons & Barrieau, 1994). Some researchers have measured learning-style preferences among Aboriginal individuals. Nuby and Oxford (1998) examined learning style preferences using the Myers-Briggs Type Indicator (MBTI) among 175 Native American students attending high schools on reservations. Students preferred learning facts and practical skills in a concrete, sequenced, and structured manner as well as intuition, as evident in their artistic and creative abilities. Extroversion was also preferred, which suggests that Native Americans take pleasure in cooperative and group oriented learning and involvement in discussions, interactions, and activities. The authors were initially surprised with the preference for extroversion because they believed that Native Americans were less likely to participate in class discussions, but further evaluation revealed that the students responded based on how they act within their own culture and not necessarily how they act in school. Native Americans also favored thinking (understanding why and learning facts objectively and logically) as opposed to feeling (personal and belief oriented). Finally, perceiving, which involves flexibility, open-mindedness, change, novelty, and exploration in the classroom, was chosen over judging, which is dead-line oriented and less flexible. Nuby and Oxford (1998) found within-group variations in learning styles, indicating that individuals of a particular cultural group do not necessarily have only one learning style. However, the authors stressed that teachers must understand cultural differences in learning patterns because conflicts and miscommunication can occur when teachers' instructional style contrasts students' learning styles.

In a related view, Simmons and Barrieau (1994) found that Native American college students demonstrated a sensing-feeling learning style. The authors state that sensing-feeling individuals enjoy student involvement, cooperative group work, and discussion, as opposed to competition. In addition, the students prefer interactive learning with a

more personal connection rather than typical lecture classes. The authors suggested that individuals learn better when instructional factors are compatible with their learning style. This finding of a preference for feeling contrasts the findings of Nuby and Oxford (1998).

Wauters, Bruce, Black, and Hocker (1989) administered the Dunn Learning Style Inventory to 200 Alaskan Native and non-Native high school students. The Native students preferred more student-teacher interaction and were more peer-oriented than the non-Native students. Both groups showed a high preference for kinesthetic, visual, and tactile learning, however, the authors suggested that most teachers promoted auditory learning in their lectures. Walker, Dodd, and Bigelow (1989) tested 28 Native American adolescents on a learning preference scale. The majority of the students preferred a patterned-symbol learning style, which focuses on personal interpretation of class material, information sharing, group activities, no time limits, and cooperation over competition. This type of learner also prefers personally interesting material and activities that allow creative expression including art, drama, dance, and creative writing.

Using a learning style inventory, Backes (1993) found that the dominant learning style among Native American high school students was "abstract random," which includes sensitivity, imagination, personal reflection, group membership, holistic belief, flexibility, and emotion. In contrast, the dominant learning style of the non-Native students was "concrete sequential," which characteristics emphasize structure, sequence, practicality, facts, and organization.

A common finding in the studies reviewed is that Native Americans appear to prefer interactive and kinesthetic learning in visual modalities, group work and cooperation, personal content, creativity, and flexibility of thought. It is also important to note that some researchers (More, 1989) caution readers against labeling learning styles because such labeling may result in inaccurate stereotyping and wrongful suggestions of brain and genetic differences. Similarly, Pepper and Henry (1986) acknowledged the individual differences that exist in learning styles and noted that Native children should not be classified as having only one learning style. Other researchers (Ryan, 1992; Sawyer, 1991) have suggested that there is much confusion surrounding the term learning style.

Hemispheric Dominance

Some researchers have suggested that Aboriginal individuals display a right-hemisphere dominant learning style. For instance, Browne (1990) examined the IQ results of many Native American children. She

concluded that many Native children have a right-hemisphere dominant learning style, which is more holistic, emphasizing visual and tactile stimuli, as opposed to left-dominant learning styles, which emphasize verbal abilities, abstract language, and vocabulary skills. Browne suggested that the reason many Native children struggle in school is because the left dominant learning style is supported in most schools. The author, however, did not present any data to substantiate her conclusion. Browne even failed to indicate what the IQ pattern was that indicated that these individuals had a right-hemisphere dominant learning style. Hence, these results must be taken with caution. Based on anecdotal evidence, Ross (1989) came to the same sketchy conclusion.

Nevertheless, Browne (1990) also stated that not all children show a dominant learning style, that many children are balanced in both hemispheres, and that dominance does not imply the use of only one hemisphere. Furthermore, not all Native American children have a right-dominant learning style, and this learning style is not limited to Native children. Lastly, one should not label children as 'right-brained' or 'left-brained' because such labeling may dichotomize learning and limit expectations.

Rhodes (1990) examined brain dominance of 424 Hopi and Navajo Native American students and adults (parents and individuals working in the school) using a test designed to measure hemisphere dominance (the Hemisphere Mode Indicator) and a learning styles inventory. The majority of Navajo and Hopi students were classified as right-hemisphere dominant. This pattern was not consistent among the school-teachers and parents, however. For instance, more Navajo teachers were left- than right-hemisphere dominant, the majority of Hopi teachers were right-hemisphere dominant, and Anglo teachers showed no difference. Furthermore, the majority of Hopi parents were left-hemisphere dominant with Navajo parents showing no clear difference. The authors focused on the finding that the majority of students were more right-hemisphere dominant and learned in more concrete, holistic, and experiential ways as compared to abstract conceptualization (left hemisphere dominance), which was prevalent among most of the teachers and emphasized in the curriculum. However, perhaps a more salient finding may be the gross inconsistency in hemispheric dominance between the students, teachers, and their parents. If Native Americans students generally show right-hemisphere dominance, then one would expect this finding to hold true for the Native teachers and parents.

Chrisjohn and Peters (1989) reviewed research and concluded that Native children are not right hemisphere dominant. They cautioned that

if Native children are classified as right hemisphere dominant, then left-hemisphere skills will be less emphasized and will decrease verbal performance. In addition, they suggested that teachers should not focus on a right-hemisphere curriculum for these children, but rather they should focus on development of left-hemisphere skills. Stellern, Collins, Gutierrez, and Patterson (1986) examined spatial and language lateralization of Native American students and concluded that the students were not right hemisphere dominant. On dichotic listening tasks Scott, Hynd, and Weed (1979) found that Native American children had a left ear advantage, implicating the right hemisphere. But in an attempt to replicate these findings with a larger sample of Native American children, McKeever and Hunt (1984) actually found that Native Americans showed a right ear advantage, thus, adding to the inconsistencies among findings.

Chrisjohn and Peters (1989) also challenged previous assertions that the unique IQ profile (performance higher than verbal IQ) indicates that Native Americans are right hemisphere dominant. The authors point out that having a lower verbal than performance IQ does not necessarily mean that the children are right-hemisphere dominant. Cultural biases may be more significant among verbal questions than performance questions (Chrisjohn & Peters, 1989), many Native Americans are bilingual, and they may be less proficient in English (Beiser & Gotowiec, 2000). These factors could lower verbal IQ but essentially have nothing to do with hemispheric dominance.

Field Dependence

Field-dependence has been studied in some Aboriginal groups. A field-dependence test is a perceptual test that assesses field-dependence/independence by requiring the individual to isolate a figure from a field of stimuli. Individuals who are field-independent perform better on this task as they are able to isolate the figure, but individuals who are field-dependent respond globally and have difficulty isolating the figure. TenHouten (1989) reviewed research on cognitive abilities of Aboriginal individuals living in Australia and concluded that they were field-dependent. Pine (1984) also demonstrated that Native Americans are more field-dependent than independent. In contrast, others researchers have suggested that Native Americans to be more field-independent than dependent (Dinges & Hollenbeck, 1978; MacArthur, 1968, More, 1989). Shade (1990) suggested that although Native Americans are thought to be field dependent, they may also be field-independent. Ultimately, Smith and Shade (1997) suggested that Native Americans are both field-dependent in school and field-independent out of school.

These results vary drastically across different studies (Swisher & Dehyle, 1989), and so no general conclusions can be made.

Teaching Aboriginal Children

The interaction style of Native children at home may be different than at school where there must be active participation in the classroom. This discrepancy may lead to communication difficulties, which emphasizes the need for overlap between learning styles at home and in the classroom environment (Swisher & Deyhle, 1987). Little Soldier (1992) suggested that schools for Native (Navajo) students should emphasize sharing, giving, and cooperation, rather than saving and competing. Also, teachers must be sensitive to Native students' beliefs of harmony with nature, religious/spiritual functions, concepts of time, family life, and language. Smith (1992) advocated for the use of culturally relevant interactive multimedia with Native (Navajo) students. Similarly, others have recommended the use of computers as teaching tools for Native children, particularly because of the emphasis on visual information (Kaulbach, 1984).

Native Americans are described as community- and family-oriented individuals, who emphasize respect over authoritarian discipline, thus, teachers are encouraged to promote a cohesive community-oriented environment that focuses on harmony, cooperation, and group work (Smith & Shade, 1997). Furthermore, because Native individuals value sharing, group reward systems typically work better than individual reward systems. The authors also suggested that Native students are generally observational learners, thus, they learn better when utilizing simultaneous and global processing. Similarly, Sparks (2000) recommended the use of cooperative learning, community and elder involvement, visual aids, oral approach with stories and songs, real life examples, and hands on learning techniques for teaching Native students. Because of their strong visual-spatial abilities, visual aids including flow charts, pictures, videos, and art are recommended to supplement verbal instruction for Native students (Smith & Shade, 1997). Nevertheless, the authors suggested that teachers should be flexible and account for the individual strengths of all children, and they should also focus on the development of logic and verbal skills among Native students.

Ryan (1992) reviewed studies examining Aboriginal learning styles and concluded that approaches promoting interactive learning approaches are effective, particularly when coupled with other approaches that will develop the students' verbal and analytic skills. The author stated that typical school systems are verbal in nature, in contrast to

the visual-spatial learning patterns common among Aboriginal. Ryan suggested that including culturally relevant school material, contextualized instruction, an emphasis on students' experience and knowledge, and a collaborative learning approach are important in enhancing Aboriginal student learning.

Brown (1995) suggested that to moderate differences between teachers and student learning patterns, teachers should promote activities to engage Native children including arts, crafts, drumming, singing, cooking, drama, films, outdoor and nature events, and athletics. It is also important to involve community members (e.g. elders) in the learning process and to employ culturally aware teachers. Pepper and Henry (1986) further suggested that teachers should promote cooperative learning, peer tutoring, and group projects in an informal, freedom-of-movement class environment. Also, instruction should be presented holistically, with emphasis on experienced-based activities that promote creativity with use of visual spatial and tactile stimuli.

Sawyer (1991) recommended that teachers of Native students should use a visual approach with less formal lectures, group and student-oriented activities, cooperation and collaborative learning rather than competition, experiential learning techniques, and multi-method instruction. In addition, the author recommended holistic instruction that integrates learning with previous experience, close teacher-student relationship, a culturally appropriate and sensitive classroom, and that the teacher acknowledge nonverbal cues and silence among the children and strive to increase student confidence and self-esteem. Swisher (1990) stated that there is ample research on the effectiveness of cooperative learning activities for Native students and thus teachers should consider using these approaches.

Browne (1990) recommended that instruction should encourage the development of all learning styles with the use of broad approaches. Yet, to enhance learning of Native children, Browne suggested that teachers should employ an informal and personal classroom environment and use strategies to help children with verbal tasks including verbalizing with pictures and flow charts, contextualize reading, and allow discussion. Holistic approaches that focus on abstract skills, visual spatial, auditory, and kinesthetic processing are also important.

It has been suggested that Native Americans are more successful when using a whole language learning approach (Kasten, 1990). Whole language learning focuses on process rather than product and emphasizes creative activities and arts. Collaborative learning and cooperative group work are also stressed, and it is important that the children are not pressured to complete all activities in a given time period. Whole

language classrooms can be community oriented, which recognizes the contribution of each individual to promote community learning. This community approach is analogous to typical Native communities where every member plays an important role in the functioning of the group. Kasten further stated that whole language learning is a holistic approach that emphasizes learning from the whole context, and that learning reading and writing parallel learning oral language. This approach focuses on teaching culturally relevant children's literature and teaching in content themes that integrate different subjects into one lesson. The author further suggested that whole language learning emphasizes more qualitative assessment as opposed to solely quantitative assessment, and promotes active rather than passive learning.

The research presented indicates that Aboriginal children may be holistic, creative, and experiential learners. Programs that have been designed to facilitate creative thinking instruction in Indigenous populations (living in Australia) have been shown to enhance creative thinking. In some cases this increase in creative thinking has led to improvements in academic achievement and thinking approaches (Edwards, 1991) but not in other studies (Ritchie & Edwards, 1996).

Despite the fact that numerous researchers have suggested that Aboriginal children are more visual-spatial learners, few have examined whether visual learning instruction that is adapted to the Native learning style actually increases learning. Kleinfeld and Nelson (1991) reviewed three studies on the effectiveness of visual learning instruction for Native American students and they concluded that this instruction does not increase academic achievement. This conclusion may be misleading, however, because in one study, the researchers did find an increase in achievement, but this increase was evident for both Native and Caucasian students. In the second study, researchers also found increases in Native learning but only for students of lower reading ability, and in the third study researchers found no increase. The three studies reviewed had flaws and were relatively old (1970s), which underscores the need for new, rigorous research in this area.

The bulk of the papers reviewed on teaching Aboriginal children are merely suggestions for how to teach. Some researchers draw conclusions based on previous research on cognitive abilities and learning styles and others base their assertions solely on anecdotal evidence. There is little or no empirical research literature on how to teach Aboriginal children and on which teaching techniques are most effective. Research in this area is imperative in order to enhance academic efficiency.

Culturally Responsive Teaching

Freed and Pena (2002) commented on the challenges of defining education and providing an empowering education for Native students. The authors stated that problems arise because of barriers including a lack of trust and communication between the community and school system. On a similar note, Sonn, Bishop, and Humphries (2000) noted that Aboriginal students in Australia have difficulties with the dominant culture in mainstream education because of differences in cultural values, levels of support, challenges of relocation, and cultural identity and insensitivity.

Cultural discontinuity can occur when Native children are assimilated into a Caucasian school system (Pewewardy, 1999). Pewewardy, along with other researchers (Mueller, 1999; Suina & Smolkin, 1994), promoted the use of culturally responsive teaching for Native American students, in which teachers are sensitive to students' needs and understand learning patterns, family structure, beliefs, values, history, and language of the students. Further, teachers must understand that factors including making eye contact between teacher and child, actively participating in class discussions, and defending statements while challenging others, which may be prevalent among Caucasian students do not necessarily hold true for Native students (Pewewardy, 1999). The author also emphasized the importance of respect in the classroom, in that teachers should understand individual strengths in cognitive styles of children and modify their instruction accordingly. Mueller specifically proposed the use of music, including singing and dancing, to promote a culturally sensitive classroom for Native students. Sparks (2000) recommended using a culturally sensitive teaching approach for Native students that builds positive images on Native Americans to increase self-concept and uses of Native words and phrases in teaching.

To ensure a culturally sensitive classroom environment, teachers must also understand cultural norms such as the use of silence among Native groups. Plank (1994) reviewed many studies indicating that there is a high use of silence among Native American groups. The author suggested that the use of silence in the classroom among Native children might be because the students do not want put themselves above their classmates and that Native culture involves more listening and watching than answering questions. Plank interviewed teachers on a Navajo reservation regarding the Native students' use of silence and their views and interpretation of it. All of the teachers noticed the use of silence among the Native children and most teachers reported some difficulty adjusting to it. Although half of the teachers had no conjectures about the meaning of the silence, the views of the rest generally

fell into four different categories. First, some teachers thought silence reflected less of a value on education among the Native students, other teachers associated it with cultural differences, or language and speech factors. Lastly, some teachers noted that the children appeared to be more visual than auditory learners, which may be related to their use of silence. As for how the teachers compensated to the use of silence some reported that the students became more verbal with time and others felt that the students worked well in cooperative learning activities. The author further noted that orientation and in-servicing about educating Native children was not provided to any of the teachers. Plank recommended that districts hire teachers who are interested in Native education and provide them with a thorough orientation and support strategies for teaching. Kleinfeld (1973) found that the use of silence among Inuit children was related to their perception of classroom climate, in that students were more verbal when they had a positive perception of the classroom.

There are also teacher factors that can influence the behavior and academic achievement of Aboriginal children. Teachers unfamiliar with Aboriginal culture may view learning style and cultural differences as evidence that Aboriginal children are less capable (Kearins, 1985). Kearins stated that teachers must learn about the skills, abilities, and cognitive styles of Aboriginal children, because misunderstandings may result in teachers instructing these children with less optimism and effort. Christie and Harris (1985) suggested that Aboriginal children in Australia have academic difficulties possibly because of culturally insensitive curricula, high staff turn-over rates, and poor attendance. Teachers should address communication difficulties, clearly state teaching and learning goals, and learn about the customs and perceptions of their students. Furthermore, even standard teaching practices, such as crossing out incorrect solutions to math problems, can be viewed as a personal attack by Aboriginal children (Christie & Harris, 1985).

Steinhauer (1996) discussed difficulties that may arise when non-Aboriginal teachers teach Aboriginal children. Cultural differences, including beliefs about time and motivation can influence the students' academic performance, and so teachers need to be flexible to avoid conflict in the classroom. Although there is evidence (York, 1990) that Aboriginal students are more responsive in the classroom and participate in classroom discussions more frequently when their teacher is Aboriginal, specialized training for non-Aboriginal teachers might help bridge the cultural gap (Christie & Harris, 1985; Lowell & Devlin, 1998). For example, teachers who are aware of Aboriginal communication patterns may be more accepting of Aboriginal children who may ap-

pear restless and avert their eyes when instructed to pay attention, because this is a culturally appropriate listening behavior (Lowell & Devlin, 1998).

Smith and Shade (1997) noted that Native Americans are not frequently referenced in educational material, thus, including culturally relevant material may make the material more salient to Native students by allowing them to identify with the information. Likewise, Anderson and Stein (1992) stated that teachers need to include culturally relevant material and real world problems in mathematics instruction to make the material more significant to Native students.

It is widely advised that including culturally relevant material is important for Native student learning. To test this assertion, Mathews and Smith (1994) compared Native children who were taught science with culturally relevant material and Native American references to a control group of Native children who were taught science without these materials. After the 10-week program, the experimental group performed better on a science achievement test and demonstrated more positive attitudes toward Native Americans and science than the control group. Despite the importance of these findings the study had flaws, many of which the researchers pointed out themselves, thus the exact mechanism for why performance increased is unclear. First, the schools and classes were not randomly selected and there were differences in teacher characteristics including teaching experience, length of teaching, and ethnicity. It is also possible that the teachers in the experimental group may have been more enthusiastic by the use of Native material, which may have enhanced their teaching (Mathews & Smith, 1994). Lastly, different results were found for Navajo and non-Navajo students, and researchers developed their own outcome measures.

McCarty, Lynch, Wallace, and Benally (1991) reported on a bilingual-bicultural curriculum introduced to Navajo students. Because many Native children are defined as nonverbal and non-analytical learners this curriculum focused on developing inductive and analytical reasoning skills with open-ended discussion. Children were encouraged to participate in class and to speak up in class or group settings. The researchers concluded that the program was successful because there was an increase in response to questions and better communication between students and teachers. Other research has shown that using a rhyme-based reading program enhances phonological awareness and word reading in First Nations children (Walton, Bowden, Kurtz, & Angus, 2001).

Again, it must be highlighted that the majority of the research in this area are suggestions for how to teach, and although they may be vi-

able, empirical research is needed to substantiate these claims. It is also important to note that teaching techniques recommended for Aboriginal children may be beneficial for all children. For instance, many of the techniques including a focus on interaction, engaging material, experiencing, group work and cooperation, visual aides and creativity would presumably be positive for many groups of children, but may not be economically feasible in classrooms today. Nevertheless, steps must be taken to improve the education of Native students because of their generally low academic efficacy.

Testing and Academic Issues

Issues about the appropriateness of academic testing must also be taken into consideration for the education of Aboriginal students. Standardized quantitative tests, particularly timed multiple choice tests, may not be appropriate for Native students because such tests do not allow careful and thoughtful approaches and they do not reflect the holistic, intuitive, and experience-based learning styles of Native Americans (Smith & Shade, 1997). Dehyle (1985) found that Native Americans have a different perception and understanding of academic tests, in that they perceived tests as less crucial for success and they were less anxious and more laid back about test taking than Caucasian students.

Hadfield, Martin, and Wooden (1992) maintained that culture, mathematics anxiety, and learning style are all related to mathematics achievement of Native Americans. The authors examined the relations between learning style and mathematics anxiety and achievement among 358 Navajo students attending middle school. The most significant predictor (from the learning style profile) of mathematics anxiety was persistence orientation, which reflects the students' eagerness to complete a task. This result indicates that mathematics anxiety is related to attitude and work effort towards mathematics for Navajo students. Hence, the authors suggested that teachers must emphasize the importance of task completion, particularly for difficult tasks, and to include challenging word problems and puzzles rather than questions and answer approaches. The best predictor of mathematics achievement was sequential skills (sequential and verbal processing), followed by spatial skills (ability to imagine and rotate objects) and categorical skills. Hadfield et al. also found a higher rate of mathematics anxiety among the Native students as compared to Caucasian students, and there was a negative relation between mathematics achievement and mathematics anxiety. The authors concluded that group work and interactive activities that focus on the relevance of mathematics in the real world are important for Native students.

Conclusions

Taken together, the research presented indicates that Aboriginal individuals appear to display a more visual-spatial than verbal learning pattern and they display some unique learning preferences. Researchers have defined Aboriginal individuals as holistic, observational, and experiential learners who prefer collaborative group work and experiential learning techniques. Cultural responsive teaching is widely endorsed, and the importance of issues involving academic testing with Aboriginal children is also stressed. Although it is important for teachers to understand the visual-spatial learning patterns of Aboriginal children, and to modify their instruction accordingly, they must also strive to develop the verbal and analytical skills of these children. A holistic teaching approach that includes visual aids to assist with verbal lessons has been recommended for Aboriginal children.

The bulk of the empirical research reviewed in this paper is focused on the cognitive abilities of Aboriginal individuals and is not contemporary. There are numerous suggestions based on how Aboriginal children learn and how to teach Aboriginal children, yet very little evidence to support these assertions. It is clear that more research must be conducted to determine whether the educational recommendations reviewed actually improve academic performance of Aboriginal children. Researchers should strive to design and implement culturally appropriate programs for Aboriginal children and also how to evaluate their effectiveness. In order to promote academic achievement among Aboriginal populations the focus must move from comparing cognitive abilities to actually testing the effectiveness of various instructional programs.

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