Research in Rural Education, Volume 6, Number 3, 1990

Visuospatial and Verbal-Sequential Performance of Rural Remote Alaskan Native, Urban Alaskan Native, and Urban Alaskan White Male Children

TERESE A. LIPINSKI[1], THOMAS N. FAIRCHILD[2], AND DALE EVERSON[2]

Assessment of minority individuals by traditional testing methods has been a concern of researchers in both education and psychology. Based on various tests primarily not intended for use as cognitive profile measures, a number of researchers concluded that differences existed between white and minority children in cognitive functioning. With the development of the *Cognitive Laterality Battery (CLB)*, visuospatial and verbal-sequential abilities can be directly measured.

This study compared cognitive profile scores of rural remote Alaskan Native, urban Alaskan Native, and urban Alaskan white male children, grades four through six, using the *CLB*. Alaskan Native boys, whether rural remote or urban, were found to significantly differ in cognitive functioning from Alaskan white boys. The Alaskan Native groups were found to have higher visuospatial as compared to verbal-sequential abilities, and the Alaskan white group was found to have higher verbal-sequential compared to visuospatial abilities.

INTRODUCTION

Educators and psychologists have reviewed patterns of test results to identify differences between populations of white and American or Canadian Indian children. Various researchers have noted that Indian children from different tribes tend to receive lower verbal scores with higher performance scores on the *Wechsler Intelligence Scale for Children,* and the *Wechsler Intelligence Scale for Children—Revised* (Cundick, 1970; Diessner & Walker, 1986; McAreavey, 1978; McShane & Plas, 1983a, 1983b; Turner & Penfield, 1952). McShane (1980a, 1980b) evaluated American Indian children's *Wechsler* test results utilizing Bannatyne's categories of Spatial, Conceptual, Sequential, and Acquired Knowledge. He found that a pattern of relatively high visuospatial abilities predominated with slightly low sequential skills, and very low verbal-conceptual skills and acquired factual knowledge.

Although McShane (1980a, 1980b) determined that the *Wechsler Intelligence Scale* provided questionable results for American Indian children, little has been done to determine if differences in cognitive style and visual perception exist which may relate to effective learning for American Indian students (Bland, 1974, 1975; Kleinfeld & Nelson, 1987). It appears that professionals have relatively little information with which to make interpretations regarding differences in performance by these children. This may result in misdiagnosis and labeling which can be detrimental to the lives of American Indian children (McShane, 1980a, 1980b). McShane (1980b) added that tools which will provide for a more adequate diagnosis and remedial prescription are important. Moving from traditional educational testing into the neuropsychological arena shows promise to meet this need.

Work by neuropsychologists (Bogen, 1969; Bogen & Gazzaniga, 1965; Gordon, 1983, 1984, 1985; Levy, 1972) has shown that there are functions requiring varied input from the right and left hemispheres of the brain. The amount of input correlates according to the cognitive requirements of a task. Levy (1974) suggested that there are two types of information processing which make hemispheric differentiation necessary. She stated that these two types of information processing would interfere and conflict with one another if located in the same hemisphere.

Gordon (1984) argued that labeling a person as right or left hemispherically dominant may be incomplete since both hemispheres of the brain appear to contribute toward performing a particular function. He suggested that it might be more appropriate to identify the functional patterns of the brain, the verbal-sequential and visuospatial abilities, according to a cognitive profile. The *Cognitive Profile Battery (CLB)* was thus developed to provide cognitive profile information (Gordon, 1985).

A substantial amount of evidence is available supporting the need for alternative approaches in intelligence testing and assessment. As new information has been presented over the years regarding the nature and definition of intelligence (Trotter, 1986), there appears to be a growing recognition that traditional testing may fall short in assessing individual capabilities and potential (McLoughlin & Lewis, 1986; Oakland, 1977; Sattler, 1988). This concern becomes even more exaggerated when issues of cultural differences are considered.

[1]National Rural Development Institute, Western Washington University.

[2]University of Idaho.

This study was undertaken to directly measure specialized function performance, visuospatial and verbal-sequential, with the intent of more clearly defining learning differences between Indian and white children. It was expected that the study results would provide additional information to the existing body of literature which infers that traditional intelligence testing must be used with caution, if at all, when assessing Indian students. Secondly, it was hoped that this information would provide insight into educational approaches which will be more productive for the Indian child's academic experience.

METHODS

Subjects

The study compared three groups: Rural remote Alaskan Native boys, Alaskan Native boys living in urban community environments, and urban community Alaskan white boys. The samples of Alaskan Native boys and Alaskan white boys living in urban community environments were taken from nine communities which are in the Kenai Peninsula Borough School District (KPBSD). The sample of rural remote Alaskan Native boys were taken from three village communities which are in the KPBSD.

Male children were selected for the study because the literature suggests that there are gender differences in cognitive functioning (Witelson, 1976). Grades four through six were selected because the developer of the measurement instrument, the *Cognitive Laterality Battery (CLB),* selected ages 9–11 as a category for the breakdown of normative data (Gordon, 1985). Each boy's age was reviewed to ensure that he did, in fact, fit into this age grouping and was a member of the fourth through sixth grades.

All boys from the KPBSD, grades four through six, hand carried to their parent(s) or guardian(s) a packet containing a description of the study, a letter of support for the study from the School District, and a human subject's release form. Packets were to be read, signed, and returned to the School District prior to testing.

Twenty-seven Alaskan white urban boys were administered the *CLB.* One white boy was eliminated from the sample population because of failure to comply with expected behavior during testing. Four additional tests were eliminated because the tests were considered invalid due to random responses and/or failure to comply with directions. The adjusted Alaskan white sample used in the study was 22 boys.

The two Alaskan Native groups consisted of 15 urban and 20 rural remote boys. The rural remote sample was taken from three Aleut and Athabascan communities that are 99% Alaskan Native in the KSBSD.

Instrumentation and Procedure

The observational research design was a one-way comparison of three sample groups. The cognitive profile scores of rural remote Alaskan Native boys were compared to the scores of urban Alaskan Native and urban Alaskan white boys. Scores of urban Alaskan Native boys were compared to those of rural remote Alaskan Native and urban Alaskan white boys.

The *Cognitive Laterality Battery (CLB)* was available for use through permission of the author exclusively for experimental purposes at the time of the study. Each boy who participated as a group member was administered the *CLB* to determine his cognitive profile score (Gordon, 1985).

The verbal-sequential portion of the *CLB* consisted of the following four tests: Serial Sounds (Series A for children through age 14); Serial Numbers; Word Production, Letters; and Word Production, Categories. The four visuospatial tests consisted of: Localization; Orientation (2-D for children through age 14); Form Completion; and Touching Blocks.

The *CLB* was structured in such a manner that it could be administered to either individuals or groups utilizing a sound/synchronized projector. A human monitor was necessary to ensure that the equipment was functioning properly, to distribute and collect materials, and to check for cheating. A series of slides and cassette tapes incorporated all instructions required for standardized administration. The *CLB* required approximately 75 minutes to complete, including rest periods, with each of the eight subtests taking from 5 to 15 minutes.

Statistical Analysis

Differences among the three groups were statistically analyzed using a Least Squares Analysis of Variance (ANOVA) with a .05 level of significance. The sources of variation were among and within the groups. A computer statistical package, the *Statistical Analysis System (SAS),* using the General Linear Model Procedure (GLM) (Ray, 1982), was used to analyze the results.

RESULTS

The cognitive profile scores of the Alaskan Native boys, whether from rural remote or urban environments, were found to be higher in visuospatial as compared to verbal-sequential skills. Alaskan white boys from an urban environment had higher verbal-sequential as compared to visuospatial skills according to the *CLB.*

When *CLB* cognitive profile scores of rural remote and urban Alaskan Native boys were compared, no statistically significant difference was found at the .05 level. This comparison challenged the expectation that the environment within which a boy lived might influence his test scores. Results reflected that the living situation probably could not be offered as an explanation for differences in scores between the two groups.

Comparison of rural remote Alaskan Native boys and Alaskan white boys from urban settings produced a statistically significant difference at the .05 level. Thus,

being an Alaskan Native or an Alaskan white boy in some way resulted in test score differences. Comparison of Alaskan Native and Alaskan white boys living in urban community environments showed similar results, drawing similar conclusion.

TABLE 1

*Least squares means of urban Alaskan Native, rural remote Alaskan Native, and urban white boys grades 4 through 6 by Cognitive Laterality Battery verbal-sequential (P), visuospatial (A), and cognitive laterality quotient (CLQ) measures**

Subtest	Group:		
	Urban Alaskan White	Urban Alaskan Native	Rural Remote Alaskan Native
P	.59 a	−.21 b	−.62 b
A	.46 a	.26 ab	−.07 b
CLQ	−.13 b	.47 a	.55 a

*Those means within a row with the same letter suffix do not differ significantly ($p < .05$) by Fisher's protected least significant difference test.

CONCLUSIONS

The results of this study supported the conclusion that Alaskan Native boys are different from Alaskan white boys in cognitive functioning. The environmental conditions of living in either an urban or a rural remote setting did not seem to be a primary influence on score differences for the Alaskan Native boys. Instead, it appeared that belonging to the Alaskan Native or Alaskan white group influenced performance on the *Cognitive Laterality Battery (CLB)* since significant differences were found between these two groups in cognitive profile scores. Alaskan Native boys performed better on visuospatial over verbal-sequential tasks. In contrast, Alaskan white boys performed better verbal-sequentially compared to visuospatially.

Studies suggested that American and Canadian Indians have greater visuospatial skills because of subsistence living (McShane & Berry, 1987; Nelson, 1969; Taylor, 1975). According to Nelson (1969), the natural environment of the north, in particular, provides few cues which allow individuals to readily move about the countryside. As a result, children are trained to respond to the smallest geographical differences for guidance. Taylor (1975), in his anthropological study, claimed that hunting requires an ability to read at a distance small signals from other hunters while stalking an animal for a kill. He pointed out that an elaborate system of sign language exists among many hunting groups for this survival purpose. Distinguishing slight variations of sounds has also been important in the hunting process. One must learn to mimic natural sounds to the point of fooling the prey while advising one's hunting partner of the current situation. Such required skills of discernment have been thought to enhance visuospatial development and, as suggested by Feldman (1974), logical thought becomes a product of man's adaptation to the environment.

Previous research has pointed toward recommending alternatives to traditional intellectual testing of Indian populations (Cundick, 1970; Diessner & Walker, 1986; McAreavey, 1978; McShane & Plas, 1983a, 1983b; Turner & Penfield, 1952) because it was believed that Indian children cognitively process differently from white children. The majority of conclusions were based on implications from tests which were not specifically established to measure visuospatial and verbal-sequential differences, but which were primarily intended to provide measurement of intellectual capabilities. The *CLB*'s primary purpose is to measure visuospatial and verbal-sequential differences. The results of this study support that Indian children differ in some way from white children in cognitive functioning.

Study results may lend some credence to the argument that people conducting educational assessments need more information regarding neuropsychology. Leavell and Lewandowski (1988) surveyed school psychologists in terms of training, usage, and application of neuropsychology in the schools. They found that the majority of school psychologists recognized that a substantial proportion of the children with whom they worked had signs of neurological involvement. These same school psychologists admitted to not receiving formal academic training in the field of neuropsychology. In a study involving children who were referred to a clinic for reading disabilities, Harness, Epstein, and Gordon (1984) found that 105 out of the 108 children seen had visuospatial abilities which were greater than verbal-sequential abilities using the *CLB* as a measure. This study additionally supports the need for school psychologists to have exposure to the field of neuropsychology in preparation for their profession.

Wittrock (1977) concluded from his research in the area of cognitive differences that it is important to understand that people process information in differing and various ways. He additionally suggested that these ways may interact with each other and that learning can be facilitated through becoming aware of how to address the different brain processing systems through the art of teaching. Certainly the results of this study support that different cognitive processing is an issue to consider in the selection of teaching approaches.

Rita and Kenneth Dunn (R. Dunn, 1983) identified five elements which they believe contribute to learning styles and ought to be addressed in working with individuals. These elements are broadly labeled as environmental, emotional, sociological, physical, and psychological. Butler (1988) has written a manual which considers teaching and learning styles. Basing her work on that of Gregorc, Butler provided information regarding teaching approaches taking into consideration the four types of abilities identified as perception, ordering, processing, and relating.

Further study is needed in the areas of cognitive laterality and possible implications for assessing children, and selection of educational approaches which may enhance learning based upon differences in cognitive functioning. Replication of this study in other parts of the United States and Canada would provide additional support for the topic of this study. Testing girls, and testing children of various ages, would also offer some valuable information. Research which compares styles of learning and cognitive functioning is warranted, and would add to understanding the relationship between these two concerns.

REFERENCES

1. Bland, L. *Perception and visual memory of school-age Eskimos and Athabascan Indians in Alaskan villages.* (ERIC Document Reproduction Service No. ED 046-549), 1974.

2. Bland, L. Visual perception and recall of school-age Navajo, Hopi, Jicarilla, Apache, and Caucasian children of the southwest (Doctoral dissertation, University of New Mexico, Albequerque, NM). *Dissertation Abstracts,* (University Microfilms No. 75-18645). 1975, *36,* 1355.

3. Bogen, J.D. The other side of the brain II: An appositional mind. *Bulletin of the Los Angeles Neurological Societies.* 1969, *34,* 135-161.

4. Bogen, J.D., & Gazzaniga, M.S. Cerebral commissurotomy in man: Minor hemisphere dominance for certain visuospatial function. *Journal of Neurosurgery.* 1965, *23,* 394-399.

5. Butler, K.A. *Learning and teaching style: In theory and practice.* Columbia, CT: The Learner's Dimension, 1988.

6. Cundick, B.P. Measures of intelligence on southwest Indian students. *Journal of Social Psychology.* 1970, *31,* 151-156.

7. Diessner, R., & Walker, J.L. A cognitive pattern of the Yakima Indian students. *Journal of American Indian Education.* 1986, *25,* 39-43.

8. Dunn, R. Learning style and its relation to exceptionality at both ends of the spectrum. *Exceptional Children.* 1983, *49,* 496-506.

9. Feldman, C. *The development of adaptive intelligence.* San Francisco, CA: Jossey-Bass, 1974.

10. Gordon, H.W. The assessment of cognitive function for use in education. *Journal of Children in Contemporary Society.* 1983, *16,* 207-218.

11. Gordon, H.W. Dyslexia. In Ralph E. Tarter (Ed.), *Advances in Clinical Neuropsychology.* New York, NY: Academic Press. 1984, *2,* 181-205.

12. Gordon, H.W. The cognitive laterality battery: Tests of specialized cognitive function. *International Journal of Neuroscience.* 1985, *29,* 223-244.

13. Harness, B.Z., Epstein, R., & Gordon, H.W. Cognitive profile of children referred to a clinic for reading disabilities. *Journal of Learning Disabilities.* 1984, *17,* 346-352.

14. Kleinfeld, J.S., & Nelson, P. *Adapting instruction to Native Americans' learning style: An iconoclastic view.* Fairbanks, AK: College of Human and Rural Development, 1987.

15. Leavell, C., & Lewandowski, L. Neuropsychology in the schools: A survey report. *School Psychology Review.* 1988, *17,* 147-155.

16. Levy, J. Lateral specialization of the human brain: Behavioral manifestations and possible evolutionary basis. In J.A. Klinger (Ed.), *The Biology of Behavior: Proceedings of 32nd Annual Biology Colloquium.* Corvallis, OR: Oregon State University Press. 1972, 159-180.

17. Levy, J. Psychobiological implications of bilateral asymmetry. In S. Dimand & G. Beaumont (Eds.), *Hemispheric Function in the Human Brain.* New York, NY: Halstead. 1974, 121-183.

18. McAreavey, J.P. *An analysis of selected educationally handicapped South Dakota Sioux Indian children's responses to the Wechsler Intelligence Scale for Children and Wide Range Achievement Test of Reading.* Doctoral dissertation, University of Colorado, Denver, CO. (University Microfilm Order No. 76-3655), 1978.

19. McLoughlin, J.A., & Lewis, R.B. *Assessing Special Students* (2nd Ed.). Columbus, OH: Merrill Publishing Company, 1986.

20. McShane, D.A. A review of scores of American Indian children on the Wechsler Intelligence Scales. *White Cloud Journal.* 1980a, *1,* 3-10.

21. McShane, D.A. *Recategorized Wechsler scores of American Indian children.* Doctoral dissertation, George Peabody College. (University Microfilms International No. 81-05463), 1980b.

22. McShane, D.A., & Berry, J.W. Native North Americans: Indian and Inuit abilities. In S.H. Irvine, & J.W. Berry (Eds.), *Human Abilities in Cultural Context.* New York, NY: Cambridge University Press, 1987, 717-786.

23. McShane, D.A., & Plas, J.M. The cognitive functioning of American Indian children: Moving from the WISC to the WISC-R. *School Psychology Review.* 1983a, *13,* 61-73.

24. McShane, D.A., & Plas, J.M. Response to a critique of the McShane & Plas review of American Indian performance on the Wechsler Intelligence Scales. *School Psychology Review.* 1983b, *13,* 83-88.

25. Nelson, R.K. *Hunters of the northern ice.* Chicago, IL: University of Chicago Press, 1969.

26. Oakland, T. (Ed.), *Psychological and educational assessment of minority children.* New York, NY: Brunner-Mazel, 1977.

27. Ray, A.A. (Ed.), *SAS user's guide: Statistics, 1982 edition.* Cary, NC: SAS Institute, Inc., 1982.

28. Sattler, J.M. *Assessment of Children's Intelligence and Special Abilities* (2nd Ed.). Boston, MA: Allyn and Bacon, 1988.

29. Taylor, A.R. Nonverbal communication systems in native North America. *Semiotica.* 1975, *13,* 329-374.

30. Trotter, R.J. Three heads are better than one. *Psychology Today.* 1986, *20,* 56-62.

31. Turner, G.H., & Penfield, D.J. The scholastic aptitude of Indian children of the Caradoc reserve. *Canadian Journal of Psychology.* 1952, *6,* 31-44.

32. Wechsler, D. *Wechsler intelligence scale for children—revised.* New York, NY: Psychological Corporation, 1974.

33. Witelson, S.F. Sex and the single hemisphere: Specialization of the right hemisphere for spatial processing. *Science.* 1976, *193,* 425-426.

34. Wittrock, M.C. *The human brain.* Englewood Cliffs, NJ: Prentice-Hall, 1977.