Cultural Variables Associated With the Recategorized WISC-R Subtest Score Pattern of Ojibwa Children in Manitoba

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Ron Teffaine

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Abstract

This study investigated the pattern of recategorized WISC-R subtest scores displayed by Ojibwa children in Manitoba and several traditional Native Indian variables that were associated with the pattern's scores. It was first hypothesized that the obtained pattern would be Spatial (Sp) > Sequential (Se) = Conceptual (Cn) > Acquired Knowledge (AK). The second hypothesis predicted significant differences among the obtained scores except for the Se and Cn scores. The third hypothesis predicted that cultural influences as measured by the Native child and adult rating-scale questionnaires would be associated with the obtained recategorized WISC-R scores.

Which particular cultural variables would significantly correlate together with the WISC-R scores was not predicted, since this study was exploratory in nature. The final hypothesis predicted a significant correlation of 0.70 between the WISC-R Sequential ability scores and the K-ABC Sequential Processing scores.

Forty subjects were randomly sampled from a population of Ojibwa students with average academic standing from a reservation school in southwestern

Manitoba. The sample was stratified by age (7 - 9 year olds and 10 - 12 year olds) and gender (20 males and 20 females). Seven school psychology graduate students including the author collected the data. The instruments used included the Draw-A-Man portion of the Goodenough-Harris Drawing Test, the Sequential Processing scale of the Kaufman Assessment Battery for Children (K-ABC), the Wechsler Intelligence Scale for Children - Revised (WISC-R), the Native Adult Rating Form, and the Native Child Interview Questionnaire.

A repeated measures ANOVA with linear contrasts generated by SAS PROC GLM computer software was used to test whether or not the difference between the mean WISC-R recategorized scores was significant. A stepwise multiple regression was computed to determine which combination of the 10 cultural variables included in the analysis significantly correlated with each recategorized WISC-R score in the obtained pattern. This was generated using SAS PROC STEPWISE computer software. The possibility of multicollinearity was ruled out by observing the magnitude of the coefficients in the correlation matrix of relevant variables and by examining the Variance Inflation Factors for each stepwise regression.

The results disconfirmed the first two hypotheses. The resulting pattern of recategorized WISC-R scores was Sp > Se > AK > Cn. Only 30 percent of the sample however exhibited this pattern. An average of 61 percent displayed the Sp > Se > AK and Cn pattern. Finally, 95 percent of the sample displayed the Sp > Se pattern. The fourth hypothesis was also unsupported. Instead a correlation of 0.52 was found between the WISC-R Se and K-ABC Sequential scores. The results of the third hypothesis were supported. Two variables correlated with the WISC-R Sp score: thinking style and level of talk when socializing. Four variables correlated with the WISC-R AK score: Amount of English spoken, level of covert verbalization, language preference at home, and childrearing style. Finally, five variables correlated with the WISC-R Cn score: level of independence, amount of English spoken, level of covert verbalization, parental learning style, and parental level of talk when socializing.

It was concluded that the present sample of Ojibwa children and other Native Indian children from isolated reservations may have a relative strength in simultaneous processing, and a relative weakness in sequential processing and metacognitive strategies.

These processing differences were presented as being culturally produced therefore the weaknesses relative to the majority culture were considered amenable to change. Finally, teaching strategies and suggestions for future research were included.

Chapter I. Introduction

Several studies spanning over a time beginning in the mid 1960's have explored the mental abilities of various ethnic groups. The earliest studies (Lesser, Fifer, & Clark, 1965; Stodolsky & Lesser, 1967) were unconventional in the use of concepts such as race, culture, and ethnicity. Indeed, the study by Lesser et al. (1965) defined a cultural group partly in terms of racial origin. Moreover, the follow-up study by Stodolsky and Lesser (1967) used the concepts of culture and ethnicity interchangeably. This lack of precision created unnecessary confusion about the causal factors responsible for the results.

Unfortunately, this type of inaccuracy has been found in studies investigating the mental abilities of Native American Indians. Although these studies used only a few tribal or cultural groups, the conclusions drawn were applied to Native American Indians as a race. For example, these studies claimed to have found an "Indian Pattern" of mental abilities on the Wechsler Intelligence Scale for Children - Revised (WISC-R)

(McShane & Plas, 1982a; Connelly, 1983). Yet, when causal factors were explored, it was culture, not racial inheritance that seemed to be responsible. To avoid this type of confusion, it is important to maintain a clear distinction among the concepts of race, culture, and ethnicity. Therefore, the conventional use of these terms will now be defined.

Race is an anthropological term representing an attempt to classify people into relatively distinct groups using ". . . recognizable or anatomical features which are inherited and little changed in the individual by environment" (Halsey & Friedman, 1980, p.587). Though many racial classification systems have been created using anatomical and biological genetic variables (e.g., skin, eye, and hair colour; head size; facial features; blood type; Rh factor; etc.), none have reached universal precision (Jolly & Plog, 1982). This means that an individual may have genetic traits belonging to more than one racial category. For this reason, some anthropologists have abandoned the concept of race and prefer to study the distribution of individual traits across populations (Jolly & Plog, 1982). Others continue to use this term with the understanding that the definition of race cannot be formulated with absolute precision (Halsey & Friedman, 1980). A popular classification system by Hooton (cited in Halsey & Friedman, 1980) includes three primary races: Caucasoid, Negroid, and Mongoloid. Under these divisions are primary and secondary subraces, and composite races (e.g., American Indian under the Mongoloid category).

Whereas race is a collection of inherited traits, culture is a collection of learned traits. A modern definition of culture was provided by Haviland (1983).

> Culture is a set of rules or standards [such as ideals and values] that, when acted upon by the members of a society, produce behavior that falls within a range of variance the members consider proper and acceptable. (p.31)

These standards of behavior serve several functions: (a) they make the actions of individuals understandable to the group, (b) they provide for the production and distribution of goods and services, (c) they provide for biological reproduction, (d) they help to enculturate new members, (e) they maintain order among the members, (f) they maintain order between members and outsiders, and (g) they motivate members to survive (Haviland, 1983).

Ethnicity refers to the particular ethnic group an individual belongs to. So, in order to understand this term, a definition of ethnic group is necessary. Ethnic group is more generic than either race or culture for it encompasses both these terms. The Encyclopedia Americana (1976) defined ethnic group as:

> Any group of people distinguished by common cultural, and frequently racial characteristics. The members of most ethnic groups have a sense of group identity, and the larger culture within which they live recognizes them as a distinct aggregation. Ethnic groups are especially numerous in countries inhabited by people of many different national origins. (p.631)

Ethnic groups then, have three properties: (1) they refer to cultural or racial affiliation; (2) they provide a sense of identity; and (3) they are embedded in a larger culture. Webster's dictionary provides the following examples of ethnic groups in America: "Negroes, Irish, Italians, Germans, Poles. . . " (Gove, 1981, p.781).

Now that race, culture, and ethnicity have been defined, the background information which led up to the research problem of this study will be briefly mentioned.

Lesser et al. (1965) were the first to conclude that ethnicity produces differences in the pattern of mental abilities. The subjects included 320 grade one students from New York city divided equally among four ethnic groups: Chinese, Jewish, Black, and Puerto Rican. Four mental ability scales were adapted from the Hunter College Aptitude Scales for Gifted Children: A Verbal Scale (V), a Reasoning Scale (R), a Numerical Scale (N), and a Spatial Scale (S). The items on these scales were purported to be common to all New York children. Furthermore, the test was administered in each child's primary language. The following mental ability patterns were found: Chinese (S>N=R>V), Jews (V>N>R>S), Negros (V>R>S>N) and Puerto Ricans (S>N>R>V). The authors concluded that the results supported a cultural difference model rather than a cultural deficit model. However, classifying the subjects by ethnicity did not rule out the possibility that racial inheritance might have had some influence on the obtained patterns.

An extension of this study was done by Stodolsky and Lesser (1967). They used the same test with 60 grade one students from three ethnic groups in Boston: Chinese, Negro, and Irish-Catholic (Caucasian). The results for the Chinese and Negro groups were virtually identical to those found in the previous study. Surprisingly, the Irish-Catholic group did not display a unique pattern of mental abilities. They attributed this to the relative difficulty the authors had in locating homogenous concentrations of Irish-Catholic families from which to select subjects. When they analyzed the amount of variation in mental ability scores that was accounted for by ethnicity, they found that Chinese ethnicity accounted for 39 percent, while Negro ethnicity accounted for 13 percent. Because this study used the terms culture and ethnic group interchangeably, their conclusions that the patterns were determined culturally were dubious at best.

Backman (1972) also found various patterns of mental abilities among different ethnic groups. She studied the 1960 test results of 2,925 grade 12 students from across the United States. After factor analyzing the results, 11 ability factors emerged. Six of these factors were used since they had the most relevance to education: Verbal Knowledge (VKN), English Language (ENG), Mathematics (MAT), Visual

Reasoning (VIS), Perceptual Speed and Accuracy (PSA), and Memory (MEM). It was found that ethnicity accounted for only nine percent of the variance in the shape of the patterns. This could have resulted from the effects of the Non-Jewish-White ethnic group, which showed little variation among the ability factors. This group was not really an ethnic group, according to the standard usage of the term. It is likely that if she had removed the results of this group from the analysis, the percentage of variability accounted for in the shape of the remaining patterns would have increased.

Hennessy and Merrifield (1976) argued that these previous studies could have found different mental ability patterns simply as a result of test bias. This is because none of the studies had factor analyzed the measures for each ethnic group to determine if the same ability factors emerged. Using 10 ability/achievement test instruments, Hennessy and Merrifield obtained the same three-factor solution (i.e., Verbal, Nonverbal Reasoning, Spatial-Technical) across four ethnic groups in New York: Black, Hispanic, Jewish, and Caucasian-Gentile. Unfortunately, after finding that the battery had cross-groups construct validity, they did not explore the patterns that might have emerged. Although these results lend some support to the argument that the ethnic patterns previously found are not due to test bias, the authors could have provided more conclusive evidence if they had factor analyzed the data from the previous studies.

So far, the evidence of these early studies points to the conclusion that ethnicity produces differences in the pattern of mental abilities. These results are not unequivocal however. Furthermore, the contribution of nature or nurture cannot be determined, since ethnic group can represent either race or culture.

Considering these conclusions, it is not surprising that numerous studies have found many Native Indian children to have patterns of mental abilities which differ from that of the U.S. majority culture. For example, the Verbal Scale performance of Native Indian children is usually well below that of the standardization sample on the WISC and its revised version, the WISC-R (Dana, 1984; Hynd, Kramer, Quackenbush, Conner, & Weed, 1979; McShane, 1980; McShane & Plas, 1984; Scaldwell, Frame, & Cookson, 1985; St. John & Krichev, 1976).

More recently, several studies have found tribal patterns of mental abilities on the WISC-R using Bannatyne's (1971) method of recategorizing the subtest scores (Connelly, 1983; McShane & Plas, 1982a; Scaldwell, Frame, & Cookson, 1985; Zarske & Moore, 1982a; 1982b). The derived scores are formed by summing combinations of subtests thought to represent the following abilities: Spatial (Sp), Sequential (Se), Conceptual (Cn), and Acquired Knowledge (AK).

Of these studies, McShane and Plas' (1982a) was the most comprehensive. They studied the recategorized score patterns of Chippewa (equivalent to Canadian Ojibwa) and Sioux Native Indian children using the WISC, WISC-R, and WPPSI tests. Unlike the WISC, which revealed a pattern similar to that found by Zarske and Moore (1982a) on the WISC-R for Navajo children (i.e., Sp>Se>Cn), their WISC-R testing resulted in a different pattern, after a repeated measures ANOVA was applied (i.e., Sp>Se=Cn>AK). Furthermore, these distinct patterns were only demonstrated by the traditional Chippewa-Sioux Native Indian children, as measured indirectly using the Traditional Experience Scale (TES). Acculturated children did not exhibit the obtained patterns. For these children, no significant differences were found among the scores (e.g., Sp=Se=Cn=AK).

Though McShane and Plas (1982a) provided convincing evidence that the degree of acculturation was likely responsible for the presence or absence of the Chippewa-Sioux pattern of recategorized scores, their article said little about which traditional variables were associated with the pattern.

Only two variables measured by the TES were specified in the article by McShane and Plas (1982a): fluency in the native language, and attendance at Indian ceremonies. Rather than grouping all the possible variables under the label of "traditional experience", a more revealing and useful approach would have been to examine a number of likely cultural variables using multiple regression. Furthermore, the necessity for this type of investigation was indicated by the authors themselves, ". . .valid identification of factors that contribute to Indian performance patterns on the Wechsler Scales remains elusive." (McShane & Plas, 1982a, p.16).

While a multiple regression approach would be an improvement over McShane and Plas' (1982a) study, a further improvement would be to ensure that the WISC-R recategorized scores had sufficient construct validity for the tribal group involved. Some factor analytic findings on the WISC-R with Native Indian children did not support the separate Sequential ability in Bannatyne's recategorization (e.g., McShane & Plas, 1982b; Reschly & Reschly, 1979; Zarske, Moore, & Peterson, 1981). The only study that supported the Sequential ability to some degree was Browne's (1984) study using South Dakota (likely Sioux) Indian children. Still, it is extremely important for correct interpretation to determine whether or not the WISC-R does in fact measure Sequential Ability for a certain tribal group when using the Bannatyne scores. One method of accomplishing this would be to correlate the WISC-R Sequential score with the Kaufman-Assessment Battery for Children (K-ABC) Sequential Processing score. The K-ABC was specifically designed to measure sequential processing, unlike the WISC-R. A significant correlation of at least 0.7 between these two scores would support the construct validity of the WISC-R's Sequential factor for the tribal group in question.

Statement of the Problem

The problem investigated was transposed into the following research questions: (1) What is the pattern of recategorized WISC-R scores shown by Ojibwa Native Indian children from a reservation in southwestern Manitoba? (2) How closely does this pattern of differential abilities match the traditional Chippewa (Canada Ojibwa)-Sioux pattern found by McShane and Plas (1982a) (i.e., Sp>Se=CN>AK)? (3) What are the cultural variables which most accurately predict the obtained recategorized WISC-R scores? (4) Does the WISC-R measure a Sequential Ability for Ojibwa Native Indian children from a reservation in southwestern Manitoba?

Theoretical/Scholarly Significance

The results of this study will be interpreted within two major theoretical frameworks. The first relates to the Theory of Mediated Learning Experiences (Feuerstein, 1979). It states that for a child to eventually attain the higher levels of abstract verbal analysis of experience as it relates to generic problem solving, the child must have an experienced, knowledgeable adult to interpret the world for him/her. This person (e.g., parent, teacher, or significant other) guides the perceptual organization, thinking, and behavior of the developing child through intentioned verbal interaction during shared experiences so that adaptive learning sets or habits become established in the child.

Feuerstein's (1979) theory is based on the notion of cultural deprivation which he defines as ". . . an individual or a group that has become alienated from its own culture. . . Alienation is reflected in a disruption of intergenerational transmission and mediational process" (p.39). This deprivation can occur in any socio-economic status group. In middle and upper class groups, the deprivation may come about as a result of disruptive family dynamics or condition of the child (e.g., organic impairment or emotional disturbance).

Schubert and Cropley (1972) provide evidence that the less integrated Native children are to the White culture, the less these children tend to analyze their experience in abstract verbal terms. They fail to formulate internalized rules that can guide them in future learning situations. No biological defect was implicated however because the Native children were capable of benefiting from verbal rules provided to them. The authors noted that Native children learn largely through imitation (a Watch-Then-Do style) in their own culture. This type of learning is fine for a traditional hunting/gathering type of society but is not as effective in a modern highly technological society. The situation may be even more accentuated in "marginal" Native families.

McShane (1980) cited a study which found that "marginal" Native families (those in the process of trying to integrate into the urban White society) had parents who interacted less frequently and intensely with their children. Because these families were in more of an "identity diffused" state, where a comfortable mixture of Native Indian and urban cultural elements had not yet been adopted, their condition may have been less beneficial to their children's verbal development than was their traditional rural culture. This clearly relates to Feuerstein's (1979) idea of cultural deprivation, an alienation from one's culture.

The Native Indian cultural value of non-interference of the child is related to Feurestein's theory (Sealey, 1980; Everett, Proctor, & Cartmell, 1983). In traditional Native cultures, children were encouraged to be independent, to learn on their own from direct experience. Feuerstein's theory cautions against this type of independent discovery learning. Guided discovery learning would be more effective in providing the child with methods of how to learn. Children do not always discover things on their own. They need a guide or mediator to facilitate their learning, especially in a modern technological society. Nevertheless, the choice to retain, modify, or eliminate this cultural value rests with Native Indian people themselves.

The second theoretical framework is provided by the Simultaneous and Successive Synthesis model of cognitive processing (Das, Kirby & Jarman, 1975; 1979). It is based upon earlier work by a Soviet psychologist named Luria (1973). Luria's theory divided the brain into three functional units. It proposed that Mental activity depends upon the coordinated interaction of these units.

The first unit involves the brain stem, reticular formation, and hippocampus. The unit's function is primarily one of arousal (excitation/inhibition) and is therefore involved in motivation. The ideal performance of this unit is to provide a match between task complexity and the required level of arousal.

This idea has been previously presented as the Yerkes-Dodson Law (Yerkes & Dodson, 1908). More recently, Hans Eysenck found that as task difficulty increases, the level of arousal that is optimal for successful task completion decreases to some degree (Monte, 1987).

The second unit includes the parietal, occipital, and temporal lobes of the neocortex. Its function is mainly one of coding in a simultaneous and successive manner and storage of information.

The third unit spans the frontal lobes of the brain, anterior to the percentral gyrus. This unit operates the meta-cognitive functions which supervise conscious activity. These functions include planning, decision-making, following verbal instructions, synthesis of information, monitoring, evaluation, and regulating actions.

The Occipital, Parietal, Temporal and Frontal units are controlled by a hierarchy of three cortical zones. Lowest in the hierarchy is the primary or projection area. Next up the hierarchy is the secondary, or projection-association area where incoming information is processed. At the top of the hierarchy is the tertiary or overlapping area. This zone requires the participation of many cortical areas and is involved in the integration of coded sensory information. The zones are organized so that the higher up in the hierarchy a zone is found, the less specific or more general is its functioning. Also, the higher the zone, the more lateralized the functions become. Therefore, hemispheric specializations are included in the model.

In the second (Parietal-Occipital-Temporal) unit, the primary projection zone receives information and analyzes it into smaller components. The secondary projection zone further organizes and codes the information. Within the tertiary zone, information is analyzed simultaneously in the Parietal-Occipital region, even if it arrives as sequential material. Conversely, the tertiary zone of the Temporal area analyzes information sequentially even if it arrives simultaneously. It is the tertiary zones which are responsible for comprehension of sentence structure and for converting concrete perception into abstract thinking.

The Simultaneous and Successive Synthesis model (Das, Kirby, & Jarman, 1975) proposes that information integration includes four units: input, sensory

The Simultaneous and Successive Synthesis
Theoretical Model

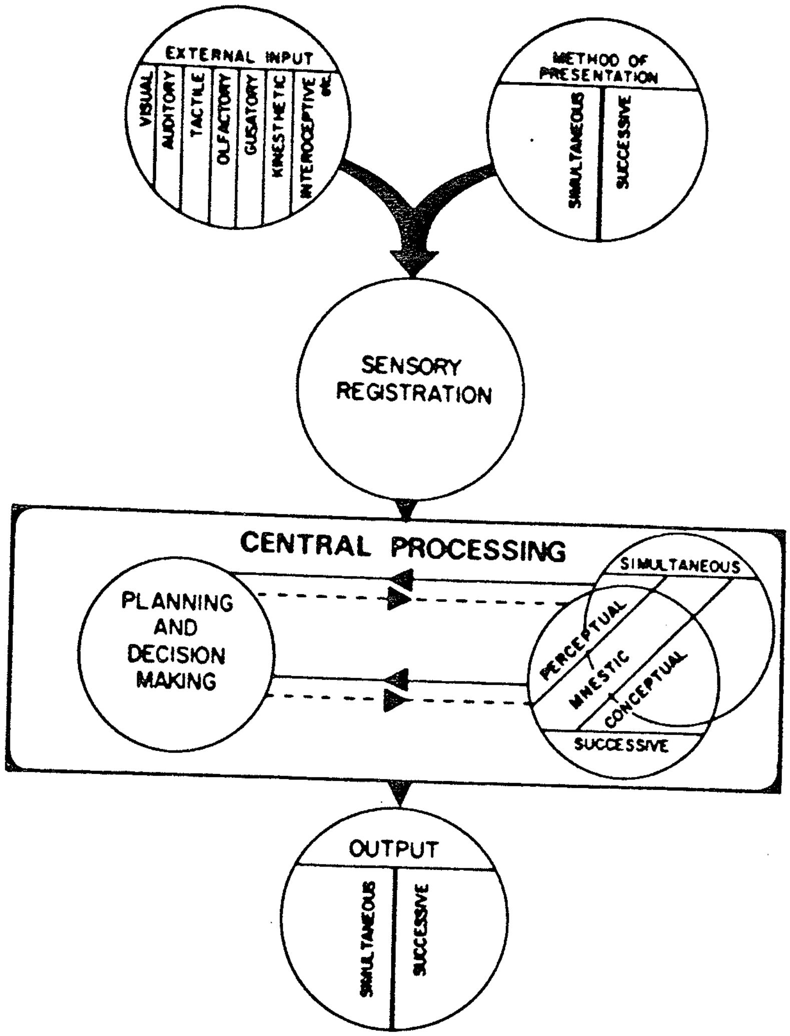

Figure 1. Diagram of the information processing components of the simultaneous and successive synthesis theoretical model. (From J.P. Das, J. Kirby, & R.F. Jarman. Simultaneous and successive synthesis: an alternative model for cognitive abilities. Psychological Bulletin, 1975, 82. Copyright 1975 by the American Psychological Association).

register, central processing, and output. These units can be seen in Figure 1.

Basically, environmental stimuli are inputted by the body's sensory organs. The stimuli may be presented in a simultaneous or successive way to the sensory register which acts as a filter so that the brain is not overwhelmed. This sensory register first processes stimuli (especially complex stimuli) in a parallel way but then reads it out to central processing in a serial manner. At the central processing unit, the brain processes information in a simultaneous way within the Occipital-Parietal lobes and in a successive way within the Fronto-Temporal lobes. Simultaneous and successive syntheses are of three types: (1) Direct perception - referring to selective attention to primarily spatial information, (2) Mnestic processes - integrating memory traces with new information, and (3) Conceptual processes - understanding systems of relationships (e.g., processing language). After information is processed in either a simultaneous or successive way, it is passed on to the frontal lobes where the information is used in planning, decision making, and regulating conscious behavior. The information can also be fed back to the Parietal-Occipital and Temporal lobes for further processing.

The model assumes that both simultaneous and successive processing are available to the individual. Since the functional units do not require any specific type of sensory information, either unit is capable of processing visual or verbal stimuli. The type of processing selected depends on two factors: (1) the individual's usual or preferred manner of processing information, determined by socio-cultural and genetic factors, and (2) the requirements of the task.

The output unit of the brain organizes behavior according to the demands of the task.

The model explains how language is comprehended and produced. Wernicke's area lies at the junction of the Parietal-Occipital and Temporal region. It is this area that is responsible for understanding the meaning of verbal information. Therefore, language comprehension involves both simultaneous and successive processing in this model. Once comprehended, the information passes to Broca's area located in the Frontal area of the brain. It is here that words are combined according to grammatical rules. Language then involves the coordinated effort of different functional units of the brain.

The importance of the Simultaneous-Successive Synthesis model is that it allows for an explanation of how socio-cultural factors can influence the relative preference for either type of processing. Factor analytic studies of the WISC-R show that Native children tend to produce subtest factor loadings which differ from the standardization sample (Reschly & Reschly, 1979; Zarske, Moore, & Peterson, 1981; McShane & Plas, 1982b: Browne, 1984). Krywaniuk and Das (1976) also found Native children on a reservation near Edmonton produced different factor loadings on their tests as compared with results from previous studies of Caucasian children. These studies suggest that many Native Indian children (especially those on a reservation) rely more heavily on simultaneous processing to solve tasks designed to measure successive processing. As a result of the mismatch between task demands and type of processing used, these Native Indian children perform worse than Caucasian children on tasks requiring successive processing. Conversely, they often perform just as well if not better than Caucasian children on tasks requiring simultaneous processing. The importance of Krywaniuk and Das's (1976) study is that the mismatch between task demands and the ideal processing modality can be remediated. Shubert and Cropley (1972) also lend support to this idea. They found that the metacognitive (verbal mediated) behavior of Cree Native children from Saskatchewan could be improved by teaching them how to discover and state problem solving rules for themselves using the verbal regulation of behavior apparatus. Gains on the WISC Similarities and Block Design subtests equivalent to that of urban whites were found for all Native Indian children.

In summary, Feuerstein's (1979) theory of Mediated Learning Experiences is important because it contributes to an understanding of how the development of abstract verbal analytic skills depends on a specific type of cultural transmission (i.e., verbal-mediation during shared experiences). It explains the impact of traditional Native Indian child rearing practices (e.g., non-interference, non-assertiveness, non-competitiveness, acceptability of silence) and empowers Native people and educators who work with Native children to expand their opportunities. This theory also enhances the understanding of remedial teaching strategies involving metacognition. The Simultaneous and Successive Synthesis model of cognitive processing (Das, Kirby, & Jarman, 1975; 1979) suggests the brain mechanisms responsible for mental abilities such as metacognition. Moreover, it allows for the idea that Native Indian cultures can influence the style of cognitive processing brought to bear on tests of mental ability and used in learning academic material.

Practical Significance of the Problem

Since the WISC-R is currently used to assess Native Indian children throughout the United States (McShane & Plas, 1984; Nuttal, 1987) and in Manitoba, Canada (McKlusky, personal communication, May, 1987; Williams, personal communication, June 9, 1987) and has been shown to have predictive validity for Native children (McCullough, Walker, and Diessner, 1985; Persi & Brunatti, 1987; Reschly & Reschly, 1979; St. John & Krichev, 1976), its proper use should be of importance to psychologists and educators interested in facilitating the academic achievement of these children. Moreover, a study designed to investigate how the WISC-R should be interpreted for Native Indian children in Manitoba has not appeared in the literature.

It is known that WISC-R Verbal Scale subtests correlate more highly with achievement tests than Performance Scale subtests (Sattler, 1982). If academic achievement, which expands vocational opportunities, is highly dependent on verbal proficiency in English, and something within the traditional Ojibwa culture may be stifling verbal abilities, then the results of this study may help Ojibwa people in Manitoba to maximize the opportunities for their children.

The differential performance of Native Indian children on the WISC-R creates a serious problem for those who must interpret the meaning of these results. The problem arises because the WISC-R was designed for and normed primarily on the majority middle-class Anglo-culture. Although the WISC-R does include American Indian children in the standardization sample, the proportion is relatively small. Basically, the WISC-R assumes that all examinees equally share in the majority culture. This seems less likely for Native Indian children who live on isolated reservations. By exploring the contribution traditional Native cultural variables have on the recategorized WISC-R scores that make up the obtained Ojibwa pattern of mental abilities, psychologists would be provided more insight into the evolution of the pattern. It would also help to eliminate rival hypotheses during interpretation.

By examining the obtained pattern, comparison of the Sp score to the Se score could reveal a preference for simultaneous as opposed to sequential processing, which also relates to teaching recommendations regarding this learning style (Kaulback, 1984; More, 1987). Moreover, the ability to provide this type of interpretation would be strengthened by a significant correlation between the K-ABC Sequential Processing score and the WISC-R Sequential score. This cross-validation is included in the research plan provided herein.

Finally, the multiple regression may provide evidence that certain recategorized WISC-R scores are affected by factors such as the amount of language used, and are enhanced by the cultural transmission of covert verbalization. If this is so, then metacognitive teaching strategies (e.g., Harth, 1982; Palinscar, 1986; Schunk, 1986; Wong & Jones, 1982) could be used to improve these type of weaknesses as they apply to the school setting.

In summary, the WISC-R has adequate predictive validity for Native Indian children, and is currently used to assess their scholastic ability throughout the U.S. and Manitoba. An examination of which cultural variables influence the obtained pattern may be helpful in its interpretation. Moreover, statements about the WISC-R Sequential ability score may be strengthened by cross-validation. The expected pattern relates to information on learning style, teaching strategies, and remedial instruction. Therefore, this study has practical significance for psychologists, educators, and Native Indian people.

Chapter II. Review of Related Literature

Unexpected Performance of Native Children on the WISC-R

There has been considerable confusion about how the WISC-R should be interpreted for Native Indian children. This has resulted because most Native Indian children studied do not perform as expected on the WISC-R. That is, their Verbal Scale performance is usually well below that of the standardization sample. The studies that follow demonstrate this.

St. John and Krichev (1976) found their sample of Ojibwa and Cree Native children to have mean Verbal Scale subtest scores as much as five points below the means of the standardization sample on the WISC. Hynd et al. (1979) found their sample of 44 Navajo primary grade children had a mean WISC-R Verbal Scale IQ of 64.14 (in the mild mental retardation range) whereas their mean Performance Scale IQ was 95.41 (in the normal or average range). The difference is 31 points. The primary language of these children however was Navajo not English. So, it is not surprising that they did poorly on a test that assesses English language abilities. Teeter et al. (1982) found the mean Verbal Scale IQ of their 113 referred but non-handicapped Navajo children was 66.06. On the other hand, their mean Performance Scale IQ was 96.33 (a difference of 30 points). Again, since their primary language was Navajo, language differences probably accounted for the severely depressed Verbal IQ scores.

McShane (1980) reviewed the scores of over 600 Native Indian children primarily under the age of 18 across 16 studies which used the Wechsler scales. Chippewa, Muncey, Ontario, Navajo, Apache, Sioux, and Papago ethnic groups were included. The median Verbal Scale IQ on the WISC-R was 79, whereas the mean was 83.50 (dull normal or low average range). The WISC-R Verbal Scale IQs were 11 to 14 points lower than the Performance Scale IQs, with a mean difference of 12 points. A difference of 12 is greater than a chance occurrence 95% of the time (Sattler, 1982). Furthermore, McShane and Plas (1984) reviewed 15 WISC-R studies and found them all to be characterized by low verbal subtest scores.

Dana (1984) suggested that the Verbal-Performance Scale IQ difference on the WISC-R may provide an estimate of the degree of acculturation, with extreme differences reflecting more traditional cultural influences. In addition, acculturation may naturally evolve to some degree over time. For example, Scaldwell, Frame, and Cookson (1985) found the Verbal-Performance Scale IQ difference displayed by Chippewa, Muncey (sic.), and Oneida Indians in Ontario had diminished in comparison to an assessment done in 1952, when the mean Verbal IQ at that time was found to be lower. Verbal IQ score improvements were attributed to the greater use of English as well as economic and educational changes in the communities.

Factors That May Contribute to the WISC-R Performance of Native Indian Children

Physiological Factors. A number of physiological factors have been suggested as possibly contributing to the low Verbal Scale scores obtained by Native children on the WISC-R. One of these traces back to mercury pollution, though this may be restricted to Manitoba. Gustafson (1978) indicated that tests conducted back in the 1970s found 25% of the 380 Native people examined had ". . . unacceptable levels of mercury within their bodies" (p.93). Mercury pollution leads to a disease called Minamata. The symptoms include hearing difficulties, speech disorders (dysarthria), and an inability to write, read, or recall sequential information such as the alphabet and familiar addresses (gustafson, 1978). The small percentage of cases however does not seem to account for the widespread findings of the subaverage WISC-R Verbal Scale IQs among Native children. Furthermore, the symptoms of the Minamata disease seem more severe than the characteristic level of verbal ability found.

Otitis Media (middle ear disease) may be more germane to the findings of subaverage Verbal Scale IQs among Native children. McShane and Plas (1984) stated that Otitis Media is the "leading identifiable disease among American Indians and Eskimos" (p.66). Moreover, the disease is rapidly increasing. According to statistics from the U.S. Indian Health Service, visits for Acute Otitis Media have increased by 42% between the years 1981 to 1986 (Toubbeh, 1987). Otitis Media is important because it has been implicated as contributing to problems such as ". . . impaired cognition, deficient or delayed language development, developmental disabilities, and behavioral problems" (Toubbeh, 1987, p.1).

A study published in 1973 found that Alaskan Eskimo children who had lost more than 25 decibels of hearing due to Otitis Media, obtained significantly lower WISC Verbal Scale scores than children with no history of Otitis Media or hearing loss (McShane &

Plas, 1984). It was also discovered that the more episodes of Otitis Media the children had experienced, the lower were their WISC Verbal Scale scores. Furthermore, those children who had contracted Otitis Media early on were delayed in school as measured by grade placements and achievement tests. This delay also widened as they progressed through the grades.

A later study found that Ojibwa children who had experienced more than four episodes of Otitis Media had larger Verbal-Performance Scale IQ differences than Ojibwa children with fewer episodes (McShane & Plas, 1984).

Toubbeh (1987) reviewed a number of epidemiological studies of Otitis Media which provide clues as to its source. It is more common among males than females. It has its highest incidence in early development (approximately 5 - 24 months of age) and then reoccurs around puberty. It is more frequent in rural than urban areas and is lateralized more often to the right ear in colder climates. This is important because the right ear has stronger connections with the left hemisphere (Geschwind, 1979). Therefore, auditory information going to the left (language processing) hemisphere may be distorted or reduced so that adequate sequential processing is interrupted during language development.

Bottle feeding may also be related to the onset of Otitis Media. The mothers of afflicted children tend to have bottle fed rather than breast fed their children as infants. This is significant because bottle feeding tends to introduce milk into the baby's Eustachian tubes. This type of feeding also occurs at a time when the infant's immune system is not fully operational. Therefore, the infant is more susceptible to infection in these early months. Bacteria from milk in the Eustachian tube may eventually damage the middle ear resulting in some degree of hearing loss.

Also reported was the overuse of antibiotics to treat Otitis Media. This tends to make the germs more resistant to the drugs, thereby reducing their efficacy. How is it that antibiotics become over-prescribed? It seems that Native children who are treated by physicians for Otitis media do not tend to receive the proper follow-up care from paramedical professionals. If the antibiotics are not ingested as prescribed, and the germs have not quite been eliminated, then the condition tends to become a chronic problem. Paramedical follow-up is needed to ensure antibiotic treatments have been successful.

The prevalence of Otitis Media in Cree Native Indian children from Manitoba was studied by Ling (personal communication, June 4, 1987) from the Faculty of Medicine at the University of Manitoba. She found no significant correlation at the 0.05 level between Otitis Media and language development. The language development was delayed however. No medical explanation for this could be found.

Chrisjohn and Peters (1986) argued that the hearing problems caused by Otitis Media cannot explain a left-hemisphere dysfunction in Native children or preference for a right-hemisphere type of processing. They cited a study comparing deaf children to normal hearing children as evidence. The test factor structure of deaf and normal hearing children was equivalent. Nevertheless, they failed to point out that only the Performance Scale of the test was factor analyzed. This scale measures non-verbal intelligence or more right-brain processing. It is difficult to see how this study supports their conclusion that hearing loss does not affect language processing abilities of the left-hemisphere, when the cited study emphasized the study of right-hemisphere abilities.

McShane and Plas (1984) identified Fetal Alcohol Syndrome (FAS) as a likely contributor to the learning difficulties of Native children. FAS is caused by an aberrant genetic makeup which results from heavy alcohol consumption of pregnant mothers. Alcoholism is apparently reaching epidemic proportions in many American Indian groups (McShane & Plas, 1984), so the likelihood of FAS occurring is intensified. The condition however results in overall mental retardation which I believe is overstating the situation. One must remember that the Performance Scale IQs of Native children usually match or excel the national average, therefore implying a condition that results in mental retardation does not fit the findings of intellectual assessment.

Neurological Factors. Another way of trying to explain the lower Verbal/Sequential subtest performance of Native children on the WISC-R is to examine the way the brain processes information. McShane and Plas (1984) reviewed two modes of thinking: appositional and propositional. The first mode represents the holistic and spatially oriented functioning of the right hemisphere. The latter mode refers to the logical, analytical, sequential, and verbally oriented functioning of the left-hemisphere. It was proposed by Bogen (cited in McShane and Plas, 1984) that an inclination to depend more on one side of the brain than the other may result from the influence of early cultural experiences. This, as the reader may recall, sounds very much like the Simultaneous and Successive syntheses model proposed by Das et al. (1975, 1979).

One piece of neurological evidence for a culturally influenced hemispheric preference involved the analysis of electroencephalographic (EEG) records obtained from Hopi Native children (McShane & Plas, 1984). The children were asked to listen to stories in both English and their own Hopi language while monitored on the EEG machine. Results showed a greater dyschronization in the right hemisphere when the stories were presented in their own language. The dyschronization was interpreted as supporting the notion of different modes of thinking.

Another study compared the performance of Navajo and Anglo children on the identification of consonant-vowel pairs presented through headphones (McShane & Plas, 1984). A different sound entered each ear. The

Navajo children recognized consonant-vowel sounds from the left ear more than the right. The situation was reversed for the Anglo children. Since the Navajo children were more successful with the left ear, it seemed to indicate a preference for appositional, right-hemisphere processing.

This cultural preference for appositional processing may vary with age and acculturation. Mckeever and Hunt (1984) studied older right-handed Navajo students in university. They found them to be just as strongly left-hemisphere superior for auditory receptive language processes as were right-handed Anglo subjects using the consonant-vowel syllable recognition task. It may be that these older subjects had either changed their style of thinking over the years or they were more acculturated than the children who were previously assessed on this type of task.

Another line of neurological research has explored the morphology of the brain using computerized brain tomograms. Significant differences in the asymmetry of the brain's shape have been found among White, Black, Oriental, and Native Indian groups (McShane & Plas, 1984). The side of the brain that has a wider parietal occipital-lobe or whether the two hemispheres are symmetrical may relate to language development and WISC-R Verbal Scale competency. One study found that adults with Dyslexia had a wider parietal-occipital lobe in the right hemisphere of the Brain (McShane & Plas, 1984). Furthermore, these adults obtained significantly lower Verbal Scale IQs than non-dyslexic adults and had Verbal Scale IQs lower than their Performance Scale IQs. Another study found right-handed dyslexic boys had a symmetrical shape to their brains but this did not correlate with Verbal Scale IQ (McShane & Plas, 1984).

Chrisjohn and Peters (1986) questioned the validity of the research that has been used to support the conclusion that Native Indians are more right-brained. They criticized the studies on brain morphology which they say did not specify the age, sex and handedness of the subjects, nor did they use "blind" procedures to measure the brains. This may have allowed experimenter bias to influence the measurements. They compared this to the early work of Samuel George Morton in 1839, whose racism biased the sampling of Native Indian and Caucasian skulls, which resulted in an inaccurate Native Indian average skull size, reported as being smaller than the Caucasian average (Gould, 1981). They also criticized the research using consonant-vowel auditory stimuli, arguing that the better designed study of McKeever and Hunt (1984) found no left ear preference for the Native subjects. Chrisjohn and Peters (1986) failed to consider however that the subjects in McKeever and Hunt's study were much older and acculturated than the Native subjects who were found to have a left ear (right-hemisphere) preference.

Chrisjohn and Peters (1986) offered a number of competing or alternative hypotheses other than brain dysfunction to account for the low verbal scores obtained by Native children. First, they argued that the WISC-R does not measure an "Indian" type of intelligence on the Verbal Scale. Working from a cultural relativism paradigm their view was that each culture fosters different patterns of abilities which are most adaptive to their environment. For Native Indian children, verbal expertise does not have as important an adaptive value as spatial skills, which are measured on the Performance Scale. Consequently, they excel on the Performance Scale. Secondly, they asserted that tests like the WISC-R are biased against Native children. Verbal items have been found to be biased and the factor structure of the WISC-R for Native children does not match that of the standardization group. In other words, the WISC-R does not measure the same things for Natives as it does for Caucasians. This is true to some degree. Although, the studies on item bias used Native Indians whose functional knowledge of the English language was limited. The WISC-R verbal items may not be as biased for those Native Indians whos primary language is English. Furthermore, most factor-analytic studies have found a Verbal-Performance (two-factor) solution for different Native Indian tribes. The two-factor solution matches the original theoretical foundation of the WISC-R as proposed by Wechsler (1974). Thirdly, it was argued that other cultural groups apart from Native Indians also perform differently on the WISC-R. And, it is unlikely that Anglo middle-class Americans are the only cultural group that have brains functioning properly to process language. Therefore, explanations of brain dysfunction in Native children who do not do well on the WISC-R Verbal Scale are unfounded. I agree whole-heartedly with Chrisjohn and Peters (1986) that the intellectual performance of Native Indian children as a whole is not the result of brain damage, but rather the result of cultural differences.

Socio-cultural Factors. Another way of looking at the subaverage Verbal/Sequential abilities of Native children is to infer the "deficit hypothesis". According to Cole and Bruner (1971) this hypothesis explains this pattern of performance as stemming from poverty conditions. These include inadequate parental attention, less guidance in how to achieve goals, less positive reinforcements, more threats, fewer explanations of social and material events, less strategy-oriented games, more confused settings, less regularity in the environment which disrupts expectations for reward, and less capacity to delay gratification.

When applied to the Native Indian situation, the deficit hypothesis would have us look at some of the things already covered in this paper: Otitis Media, Alcoholism and Fetal Alcohol Syndrome, mercury pollution and Minamata disease, discrimination and marginality, Feuerstein's notion of the culturally deprived (i.e., those alienated from their own culture), and other factors like lead poisoning, poor nutrition, overcrowding, poor hygiene, and greater mobility disrupting structured educational activities.

Cole and Bruner (1971) argued that the "deficit hypothesis" cannot be used to explain the differences in competence found between various cultural minority groups and the majority Anglo culture. They presented three major reasons in support of their assertion. First, a different culture produces individuals with equal intellectual capacity but how it is manifested depends on how the culture constructs its view of the world. Secondly, they argued that language is largely related to the construction of this world view and that one language is no more sophisticated than another. For example, ". . . Cree [one of the Algonquian Native languages in Manitoba] is not a 'primitive' language, but is considered by linguists to be one of the most highly developed in the world" (Sealey, 1973, p.88). Finally, experiments that have found ethnic minority groups as lacking in intellectual competence do not control for the way in which the subjects interpret the standardized stimuli given them. Nor do they control motivational factors regarding what aspects of an experimental task they consider important. Evidence from Labov (cited in Cole & Bruner, 1971) is offered to illustrate this point. It was found that Black children performed better in an assessment of language when the assessment conditions were changed from a formal setting to the child's own home setting. Changing the conditions in this manner likely made the task more relevant thereby increasing the child's motivation. The main point however is that situational factors make it very difficult to infer competence directly from performance.

Cole and Bruner (1971) clearly favored a "difference Hypothesis". In this regard, it is not Native children who have something wrong with them when they score poorly on a test designed for another culture. The problem lies with the test itself. The test cannot adequately measure the child's innate potential. Feuerstein (1979) states that ". . . the overlap between different cultures in the area of intellectual functioning, which can be tapped by psychometric measures is not sufficiently large to guarantee relevance of a test for one cultural subgroup when the test was originally developed for another" (p.36). I agree with this except for ethnic groups that share a common majority culture within the same country.

Though the difference hypothesis has some attractive features, such as respect for the validity of all cultures and languages while cautioning us against the inappropriateness of using a test designed for one culture to measure the capacity of an individual from another culture, it fails to account for the fact that most individuals from minority cultures or ethnic groups must adapt to the demands of the majority culture. That is, if those individuals want to benefit from the opportunities and resources of the larger culture.

It is quite likely that the WISC-R does not measure all facets of "Native Indian intelligence", or even a good sampling of those abilities that would produce success in a traditional (e.g., hunting and gathering) Native Indian culture. Nevertheless, Native children are being educated in schools so that they will have the opportunity to attain success in the majority Anglo culture if they so desire. Furthermore, the WISC-R has been shown to predict academic achievement for Native Indian children (e.g., McCullough, et al., 1985; Persi & Brunatti, 1987; Reschly & Reschly, 1979; St. John & Krichev, 1976). A "Native test" would probably not predict academic success in the majority culture's schools. For example, an intelligence test designed specifically for those of the black minority culture called the Black Intelligence Test of Cultural Homogeneity (BITCH), has been found to be a poor predictor of success in the U.S. majority culture (Sattler, 1982).

The cultural difference hypothesis directs us to consider those factors intrinsic to the Native culture which may interact with the testing situation and task demands. Spence (1973) reported that Native people have a tendency toward observational learning when confronted with novel situations before they decide to act. More (1987) called this the Watch-Then-Do style of learning. According to Kaulback (1984), the Native childrearing practice of having the child observe parents, elders, and older siblings has encouraged the child to learn through a visual mode. It is an apprenticeship type of learning where imitation plays a big part, in contrast to White children whocome from families where fewer activities are directly shared with adults and older siblings. As a result of this, question-asking and verbal communication become important to the White child's learning. Native children consider question-asking to be an interactive strategy reserved for the school. At home, questioning is minimized whereas observation and participation in activities with parents and older siblings are more frequent. In fact, too much questioning is thought of as rude, because disclosure about oneself gives others more power over you to change your opinions or hurt you (Everett, Proctor, & Cartmell, 1983).

A related cultural value is the parent's belief in non-interference of the child (Everett, et al., 1983). Native children have typically been encouraged to be independent and learn from direct experience if not observing someone working or playing (Sealey, 1980). A Native man named Wilfred Pelletier (1974) recalls the importance of observation and independence when learning as a child:

> I grew up in a community where kids were allowed to discover everything for themselves, by personal observation rather than formal instruction. . . . We made the same discoveries that other people had made centuries before us, but they belonged to us, they didn't belong to some despot or expert, someone who tells you, I've got the answers, so you quit being curious, quit exploring. that

> didn't happen to me until I went to school. From then on it was a matter of suppression. (p.103)

Pelletier's quotation relates to the idea of discovery learning and illustrates the unfortunate results that may occur when learning style and teaching style don't match.

Following the idea of independent observation, More (1987) indicated the Native person has a preference for global, holistic, parallel or simultaneous synthesis, and imagery coding. He suggested Native people may learn more easily if an 'advance organizer' or Gestalt is used to present new information. This would tap into the Native's strength in processing. Wilfred Pelletier (1974) provides a useful explanation of this holistic preference when learning:

> It is hard for us Indians to make sense of the segmented approach to learning taught in the schools to study 'chemistry' or 'math' or 'French' without relating them to each other and to some larger whole. We Indians approach things the opposite way. We start with the whole and examine every part in relationship to that whole. This is

> because our way of life was total, nothing was outside it, everything was within. (p.104)

The above quotation cautions teachers working with Native children to show how all subjects taught in school relate to one another. One way could be to use the ideas of language or mathematics across the curriculum. Furthermore, Pelletier's (1974) opinion suggests that teachers should make education directly applicable to the daily lives of Native Indian students, so they can appreciate and value what is taught.

As a result of a preference for observational learning, and parental non-interference and permissiveness, it was not surprising that Shubert and Cropley (1972) found that Native children do not habitually analyze their experiences in an abstract verbal manner. This could put them at somewhat of a disadvantage on WISC-R subtests like Vocabulary, Similarities, Comprehension, Information and Arithmetic, which all place emphasis on verbal proficiency and analysis. Of course, the amount of English spoken in the child's home would certainly have a bearing on how well the Native child performs on verbal subtests (Everett et al., 1983). McShane (1980) found one study that had selected Native children for their command of the English language. The children performed within the normal or average range on WISC-R Verbal Scale subtests.

Other Native cultural values seem to stifle the use of language. Although Native languages are just as valid and sophisticated as English, it is the use of English that is necessary to benefit from the opportunities of the majority Anglo culture. Therefore, what is most important in terms of academic success, is how Native values may affect the use of English.

Native people have traditionally preferred not to stand out amongst their peers (Everett et al., 1983). They would rather be modest and humble about their accomplishments. They consider what is best for the group over what is best for themselves. A good example of this humility is illustrated by Adelaide McDougall, a Native elder from St. Theresa Point in Manitoba:

> I am not trying to make a name for myself when I deliver a baby. The One who gave us life to live on this earth is the One I think of when I deliver a baby. (Rivais, 1985, p.107)

Ms. McDougall prefers not to take the credit for her skills as a midwife, though she realizes she has a gift or talent for delivering babies.

Native people also tend to be stereotypically non-assertive and frown upon arguing (Everett et al., 1983). They prefer to repress their conflicts (Sealey, 1980), inhibit anger and anxiety (Spence, 1973), and speak softly (McShane & plas, 1984). They would rather cooperate with their peers than compete against them (Sealey, 1980; Everett et al., 1983). An example of this cultural value is provided by Johnnie Mason, a Native elder from St. Theresa Point in Manitoba:

> I never tried to act big about my job. . . I saw, many times, men trying to out do each other on the freight trains. They didn't last very long. Those men just couldn't handle their competition very long. I never competed with my fellow workers. Let me tell you, if there is too much competition in any work, the workers don't really get along, even today (Rivais, 1985, p.33).

Mr. Mason tends to observe the detrimental aspects of competition, which certainly exist. On the other hand, competition in moderation may have beneficial results. It may provide the motivation for an individual to excel in his/her school, sport, or occupation. Consequently, it may increase the quality and quantity of one's production. This leads to improved products and services, which are a benefit to all of society. The latter view reflects the Anglo-European culture's notion of competition. Each view serves a purpose, and in the right context both may be adaptive.

The Native Indian preference for cooperation with others also goes hand-in-hand with an emphasis on sharing. Native society values and respects those of its members who share with others rather than save for themselves (Kirkness, 1973; Sealey, 1980). This may hinder a Native person's motivation to succeed in school and business so that material wealth can be acquired. These practices evolved out of necessity. Consider for a moment a culture which relies on hunting and gathering for food. Resources can become scarce because of such factors as drought, the cold temperatures and snow cover of winter, animal and plant diseases, and the unpredictability of successfully killing an animal for food. Sharing food with others beyond one's own family would be necessary for the survival of all. In fact, there are historical records of massive starvation among Native Indian peoples in

Manitoba stressing the fragility of the ecological balance (Brown, 1986).

The emphasis Native culture places on cooperation, sharing, modesty, humility, non-assertiveness, and minimal disclosure sounds virtuous even from an Anglo-Majority cultural perspective. Nevertheless, without the flexibility to be competitive, assertive, argumentative, inquisitive, and free to express one's opinions, beliefs, and feelings, it may be difficult to develop and exercise the verbal skills needed to be successful in the majority culture's schools and businesses. Native people also tend to feel quite comfortable being silent for extended periods of time when socializing (Kirkness, 1973). This also prevents the exercise of verbal skills. Together, all these factors may have a detrimental effect on the WISC-R Verbal Scale IQ level Native children attain.

Several characteristics of Native culture may affect the level of motivation in the child. Kirkness (1973) indicated that the degree of parental involvement in and concern for the child's education may be a significant predictor of academic achievement. Das, Manos, and Kanungo (1975) found that Native parents near Edmonton had aspirations for their children that were comparable to the limited aspirations of low SES White parents. This attitude of low SES White parents toward their child's education was a significant predictor of poor reading and mathematics achievement. Another Native value related to motivation is a present time orientation and an unhurried attitude (Sealey, 1980: Everett et al., 1983). The present time orientation may interfere with planning ability and sequential thinking as assessed by the WISC-R. The unhurried attitude does not seem to hinder success for Native Indian people on WISC-R timed subtests since they generally do well on Performance Scale subtests which are timed.

McShane and Plas (1984) reviewed some non-verbal communication differences between Native Indians and Caucasians. Native people tend to look down in face-to-face encounters when communicating. This is a gesture of respect, which is illustrated by Charlie Harper, a Native elder from St. Theresa Point in Manitoba:

> We had the utmost respect for our mothers-in-law. We lowered our eyes when we saw her; we did not joke about her, and we did not speak to her. (Rivais, 1985, p.96).

This lack of eye contact may not be a hindrance to Native people if they do in fact have superior simultaneous (right-brain, Parietal-Occipital) processing. This global/holistic processing strength would allow them to read the expressions and gestures of people more easily. Therefore, the occasional glance may be sufficient to gather feedback during a conversation. This heightened sensitivity to non-verbal communication may be why Kleinfeld (1973) found a teacher's non-verbally communicated warmth (i.e., smiling, sitting with close proximity, and mutually seated posture) had a significant effect on the Digit Span and Information subtest performance of Indian and Eskimo subjects on the WAIS.

McShane and Plas (1984) also identified an Ojibwa etiquette manual that specified non-verbal rules for "How to get information without asking questions and how to answer questions without giving any information" (p.69). These cultural rules, if followed, could interfere with the practice and development of English verbal skills needed to perform well on the WISC-R Verbal Scale and in school.

Further information about Ojibwa (Saulteaux) traditional practices and beliefs was provided by

Hallowell (1967) and Brown (1986). The Ojibwa thought of dreams as an important way to obtain knowledge and power. It was typical of boys at puberty to go into the woods on a dream quest to obtain the power of some animal spirit that would last them the rest of their lives. This was also typical of their Cree neighbours. Moyer Flett, from Island Lake reserve in Manitoba recalls this tradition as told to him by his father:

> He told me that one old Indian way was to go out alone into the lake on a rocky reef and sleep and fast. If you couldn't sleep you would tell yourself a story about the spirit you wanted to help you. Sometimes you would lie there for eight days sleeping and fasting. If everything worked out you would get the spirit you asked for and you could use that all your life. (Rivais, 1985, p.25).

The importance of dreaming to acquire knowledge seems related to the Native Indian's preference for imagery coding as suggested by More (1987) and the preference for simultaneous (right-brain, Parietal-Occipital) processing suggested by Das et al. (1979).

Hallowell (1967) and Brown (1986) described the historical Ojibwa belief that some people may actually be spirits (i.e., other-than-humans) with great powers disguising themselves as real people. Consequently, the Native person must approach a stranger with caution, restraint, and an agreeable disposition so as not to anger the stranger and cause retaliation. If the stranger was really a metamorphasized spiritual entity with superhuman powers, the Native person could be facing severe consequences after a simple argument. This suspicious attitude if present today in some Native children could affect rapport and possibly inhibit verbal answers in a testing situation.

In traditional Ojibwa culture, experience was individualized and unpredictable (Brown, 1986). Experiential inconsistencies did not necessarily invalidate someone's account of the "truth". For example, if someone claimed he had seen a rock floating in the air, this inconsistency with the usual habit of rocks to fall would not necessarily invalidate the account of the floating rock. This type of logic would therefore create more uncertainty in the world, preventing the use of rules and principles to explain nature. To the extent that this type of thinking lingers today based on old beliefs, it may affect the performance of Ojibwa children on the WISC-R

Information and Similarities subtests. For instance, if a child has difficulty knowing something with certainty because there exist different versions of the facts that he/she cannot reconcile, then performance on the Information subtest which calls for factual knowledge may suffer. Further, if generalizations are impaired, then how can an Ojibwa child relate concepts using superorder classifications on the Similarities subtest?

In summary, this chapter has presented various physiological, neurological, and socio-cultural factors that may affect the performance of Native children on the WISC-R. Physiological factors may account for some degree of the subaverage WISC-R Verbal Scale performance, although they may vary from one geographical area to another and do not seem prevalent enough to account for the widespread WISC-R results. In some cases, physiological problems like Minamata disease and Fetal Alcohol Syndrome produce intellectual deficits that are more severe than that found in surveys of Native intelligence. Neurological factors partly explain the functioning of the brain as it relates to manifested behavior but how the processing differences arise (if in fact they do exist) requires further research. Socio-cultural factors seem to be the most logically defensible explanation of subaverage WISC-R Verbal Scale performance. In particular, those factors affecting English language development and style of learning directly relate to and match the severity of handicap on the WISC-R Verbal subtests.

Different Uses of the WISC-R with Native Children for Placement Decisions

One common practice to aid placement decisions is to supplement the WISC-R with non-verbal "culture-fair" tests like the Progressive Matrices. The assumption is that non-verbal intelligence tests are less influenced by cultural differences than are verbal intelligence tests. This is reflected in the prevalence of the use of non-verbal tests in most of the local education agencies reported by Nuttal (1987). This practice may be somewhat erroneous however because many studies have found that minorities do no better and, in fact, even worse than Whites on these non-verbal tests (Anastasi, 1982; Sattler, 1982). For instance, Das, et al. (1975) found that grade 4 Cree Indian children near Edmonton performed less well on the Coloured Progressive Matrices than White children, regardless of SES. Therefore, as Sattler (1982) has stated, "The available evidence suggests that culture-fair tests do not show greater validity for ethnic minorities than do verbally loaded tests, such as the . . . WISC-R" (p.382). For those who believe that nonverbal "culture-fair" tests are the answer for minorities, it should be remembered that "no test can be created that will entirely eliminate the influence of learning and cultural experiences" (Sattler, 1982, pp.382-383).

Even when Native Indian children perform better on a so-called culture-fair test, it does not predict academic achievement as well as a more verbally loaded test such as the WISC-R. For example, Persi and Brunatti (1987) compared the performance of Ojibwa Native children to non-Native children from the Georgian Bay region of Ontario. They used the Category Test (a non-verbal abstract reasoning test) and the WISC-R. These tests had good concurrent validity with a correlation of 0.81. They found that the Ojibwa children obtained significantly higher scores on the Category Test than the non-Native subjects. Nevertheless, only the WISC-R significantly correlated with their academic performance. Therefore, doing well on a non-verbal instrument like the Category Test is of little use if it does not have adequate predictive validity.

In spite of this, some researchers have recommended that the relatively non-verbal Performance Scale of the WISC-R be used as the least biased measure of overall intelligence for Navajo children (Teeter, Moore, & Peterson, 1982). Still another group recommended using a prorated Performance Scale score excluding the Picture Arrangement subtest as the least biased measure for these children (Hynd et al., 1979). Finally, McShane and Plas (1984) tried supplementing WISC-R Performance Scale subtests with various subtests from the Illinois Test of Psycholinguistic Abilities (ITPA). In particular, they found combining the WISC-R Object Assembly subtest with the ITPA Visual Association and Auditory Closure subtests predicted reading achievement. Further, the WISC-R Picture Arrangement subtest combined with the ITPA Grammatical Closure and Sound Blending subtests predicted mathematics achievement. The subjects used were Chippewa children from a reservation.

Another idea to try and reduce the test bias of the WISC-R is to use a weighted formula. Pray (cited in McShane & Plas, 1984) developed such a formula. It involved adding 9 points to the obtained Verbal IQ, 3 points to the Performance IQ, and 7 points to the Full Scale IQ. In essence, the formula is a type of handicap score which emanates from the "cultural deficit" hypothesis.

A more sophisticated approach of this type is provided by the System of Multicultural Pluralistic Assessment (SOMPA) developed during the 1970's by Mercer (Anastasi, 1982). The SOMPA is a prefabricated assessment battery. It supplements the WISC-R, used as a measure of school functioning level (SFL), with the Adaptive Behavior Inventory for Children (ABIC) and minority-cultural norms to provide an unbiased estimated learning potential (ELP). The ELP is essentially an adjusted Full Scale IQ taking socio-cultural differences into account. Even Feuerstein (1979) who is opposed to static IQ measures, admitted that the SOMPA's approach may do justice to the "culturally different". Actually, Reschly (1981) found that supplementing the WISC-R with the ABIC and ELP reduced the disproportionate number of Native Papago children eligible for classification of mild mental retardation (< -1 2/3 S.D. criterion) from 37% to 0%. This new proportion was better equated with the proportion of those eligible from White, Black, and Hispanic groups. Of course, the utility of this approach rests on the assumption that minority group children will be better off without special education placement. The ELP does not however predict school achievement in the regular Anglo-cultural classroom. It predicts the minority child's achievement in a classroom that incorporates the child's socio-cultural differences (Anastasi, 1982).

Another method for reducing the WISC-R's bias to facilitate placement decisions is to omit or replace biased items. Vernon (1977) suggested seven items on the Information subtest of the WISC-R be replaced with his own Canadian content items to remove the American bias in the test for Canadian children. The suggested changes may be seen in Table 1.

Table 1. Summary of Recommended WISC-R Changes for Canadian Use

Original Information Subtest Item No.		Recommended Substitution	Acceptable Answers
16.	Bulb	Who invented the telephone?	Bell, or Graham Bell
17.	1776	From which country did most of the first settlers in Canada come?	England, Britain, Scotland, or France
19.	Border	Name three oceans that border Canada.	Accept Arctic and <u>either</u> Atlantic or Pacific, <u>or</u> both
20.	Ton	How many weeks are there in one year?	52
21.	Chile	In what continent is Sweden?	Europe
24.	Tall	How tall is the average Canadian man?	5'7" - 5'11", 170 - 180 cm
27.	LA/NY	How far is it from Toronto to Vancouver? (For children living in or near to Toronto, substitute Montreal)	1700-2700 miles, or 2700-4300 kilometers

Vernon (1977) found the new items administered to Canadian children matched the pass-percentage found using the old items with the American standardization sample. These suggested changes may be fairer to Canadian Native Indian children.

Marx (1984) analyzed Vernon's WISC-R item replacements using a sample of 210 normal children across four grade levels (4, 6, 8, 10) in Vancouver, British Columbia. Item difficulty was compared between the seven original items and Vernon's items. The new items produced a more orderly progression of difficulty than the original items had done for the Canadian children. Also, the new items were as difficult for Canadian children as the original items had been for the American standardization sample.

Marx (1984) replicated this study on a sample of 52 referred Canadian children from Vancouver, British Columbia. He found that the referred children scored slightly higher using the new items than they did using the original items. Finally, most items provided good discrimination except for item 24. Marx concluded that Vernon's suggested items should be adopted for use with Canadian children.

Studies of item-bias on the WISC-R for Native children have found different items to be biased depending on such factors as tribal affiliation or geographic location. Mishra (1982) found a total of 15 WISC-R items that were significantly biased at the .05 level against Navajo children in Arizona. These included items 12, 15, 16, 17, and 19 on the Information subtest; items 10, 11, 13, and 14 on the Similarities subtest; and items 9, 16, 17, 18, 19, and 20 on the Vocabulary subtest. The Navajo subjects in this study were from an isolated reservation and had little if any opportunity for interethnic interactions. This study did not however comment on how well the Navajo subjects understood English or to what degree they spoke English in their daily lives. It could be that English was a second language for them. Therefore, it is likely that the results are not applicable to Navajo subjects who are more integrated into the majority culture and who use English as their first language.

In contrast, Seyfort, Spreen, and Lahmer (1980) studied the item-response characteristics of three Native Indian bands from North Vancouver Island probably of the Nootka tribal group. They found only 60% of the WISC-R items contributed to total test score variability and only 25% of these were within an optimal difficulty range. Pooling together the results of the three bands, they found 15 items were misplaced in difficulty level across seven WISC-R subtests. Only four of these items were the same as those found by Mishra (1982). These included item 19 of the Information subtest and items 9, 17, and 18 of the Vocabulary subtest. It was suggested that the results may have been affected to some degree by bilingualism on the reserves. The children received their formal education however from integrated schools off the reserves. It should be noted that Vernon's (1977) suggested changes for use with Canadian children had not been incorporated.

Mueller, Mulcahy, Wilgosh, Watters, and Mancini (1986) found for Canadian Inuit children, that there was little evidence to suggest item ordering changes or content revision beyond those made to adapt the WISC-R to include Canadian content. In total, there were only two items misplaced in terms of difficulty: item 4 on the Picture Completion subtest and item 9 on the Comprehension subtest.

Finally, Ross-Reynolds and Reschly (1983) found item-bias likely within the Information, Arithmetic, and Picture Completion subtests for Papago children from southern Arizona. Items 7 and 13 on the Information subtest and item 6 on the Arithmetic subtest were considered most likely.

Among these various Native Indian groups, there were different subtests and items that contributed to bias. This makes any generalizations or adjustments for Native Indian children as a whole untenable.

Another method of compensating for the WISC-R's bias against Native children has been the use of interpreters to administer the WISC-R in the child's Native language. Nuttal (1987) reported that all local education agencies (LEAs) in the United States surveyed used interpreters for Native Indian children. In half the LEAs, the interpreters were staff members. In others, they were hired especially for this purpose, or family and community members were relied upon to do the translating. There are some problems with this practice however. For example, variations in dialect may not be covered by the interpreter, leading to misunderstanding. Furthermore, some test items may not have direct and meaningful translations.

In summary, this section has reviewed various uses of the WISC-R with Native children to facilitate more equitable placement decisions. The use of "culture-fair" tests to supplement the WISC-R may not be any easier for Native children, nor do they predict academic achievement in school as well as the WISC-R alone. The use of the SOMPA, with its ELP derived from minority-cultural norms, shows some promise of reducing overrepresentation of Native children in Special Education but it is not designed to predict academic success with a curriculum that does not incorporate Native cultural content. Trying to eliminate biased items may be futile, because there appears to be little consensus across Native cultural groups as to which items are biased. The best one can do about biased items for Canadian Native children is to use Vernon's (1977) suggested replacements for the WISC-R Information subtest. Finally, translating Verbal Scale subtests into a Native child's traditional language not only presents problems of dialect variations and loss of equivalent meaning but is of little value unless the child is going to be taught using the traditional Native language.

Research On the Interpretation of the WISC-R for Native Children

To understand the interpretation of the WISC-R for Native Indian children, some background on the original factor analytic studies with the standardization sample is necessary for later comparison. Three factors have been found on the WISC-R for the original standardization sample: Verbal Comprehension, including the Information (I), Similarities (S), Vocabulary (V), and Comprehension (C) subtests; Perceptual Organization, including the Picture Completion (PC), Picture Arrangement (PA), Block Design (BD), Object Assembly (OA), and Mazes (M) subtests; and Freedom from Distractibility (FFD), including the Arithmetic (A), Digit Span (DS), and Coding (CO) subtests (Kaufman, 1975; Silverstein, 1977). This factor structure has not yet been replicated for Native American Indians.

Reschly (1978) was only able to find a two-factor solution for his sample of Papago children. One was a Verbal factor (I, S, C, V) and the other was a Performance factor (PA, PC, BD, OA). Zarske, Moore, and Peterson (1981) expanded this study to include learning disabled Papago as well as Navajo children.

They found the same two factor solution was most representative of their sample's performance. These findings support the use of the original Verbal-Performance design of the WISC-R. Yet, unlike the standardization sample, these Native children did not display the FFD factor in their performance.

McShane and Plas (1982b) found a three-factor solution using Varimax Rotation for Chippewa children. These children were sampled from a reservation school in the Northern Midwest United States. Factor I was identical to the Verbal factor found in the standardization sample and in the other Native Indian samples. The other two factors however were composed of subtests differing from anything previously found. Factor II included A, DS, BD, I, S, and V. The underlying skill responsible for this factor could not be determined. Factor III included BD, OA, and M, interpreted as a Spatial Processing factor. It was concluded that a simultaneous-successive model was not supported with these Chippewa children. Furthermore, it was surmised that the relative isolation of these children as compared to the Papago children in Reschly's (1978) study was responsible for the atypical factor results.

Browne (1984) factor analyzed the WISC-R responses of South Dakota (probably Sioux) Indian children. She found a four factor solution that differed by gender. Factor I included the typical Verbal factor (I, S, V, C) found in all studies. Only with this factor the subtests were the same for both males and females. Factor II resembled the Perceptual Organization factor, including only Performance Scale subtests. Only three out of the five subtests previously found to load on Factor II (i.e., PC, PA, BD, OA, M) were revealed for the Native children. In particular, the males had the following subtests load on Factor II: BD, OA, and PA. In contrast, the females had the BD, OA, and CO subtests load on Factor II. Males displayed more of the typical third factor (FFD: A, DS, CO) than did the females. Factor III for the males included A, DS, and C, whereas A and PA were included for the females. A "Quasi-Specific" fourth factor had no subtests at all common to both sexes. Older males had PC load positively and CO load negatively on this factor. This dichotomy was interpreted as a right-brain (intuitive, holistic) vs. left-brain (linear, sequential) cognitive processing continuum. The females had DS load highly on the fourth factor. For females, this fourth factor may be measuring something like auditory sequencing memory.

Another line of research on the interpretation of the WISC-R for Native Indian children has focused on a recategorization of subtest scores into four abilities. Based on his clinical observations, Bannatyne (1971) suggested that WISC subtest scores be recategorized to facilitate the diagnosis of dyslexic children. In particular, he recommended the following recategorizations: PC, BD, and OA were to represent a "Spatial Ability"; C, S, and V were to represent a "Conceptualizing Ability"; DS, PA, and CO were to represent a "Sequencing Ability"; and I, A, and V were to represent an estimate of the child's "Acquired Knowledge". Bannatyne (1971) found a specific pattern of differential competency in the four ability clusters for genetic dyslexic children. This pattern was as follows: Spatial (Sp) > Conceptual (Cn) > Sequencing (Se) abilities.

Rugel (1974) reviewed many factor analytic studies done on the WISC which justified Bannatyne's recategorization of scores into Sp, Cn, and Se categories. He did find however that PA was misplaced as a Se ability, because it loaded highest on the Sp factor. Bannatyne (1974) subsequently replaced PA in his Se category with the A subtest on Rugel's recommendation. After reviewing 22 studies of poor readers, Rugel (1974) found them to have the same pattern of recategorized scores as Bannatyne had found with only genetic dyslexic readers. Therefore, the Sp > Cn > Se pattern was actually representative of most disabled readers in general.

Kaufman (1979) reported that Bannatyne's recategorization of WISC subtests was also appropriate for the WISC-R. In fact, Bannatyne's Cn, Sp, and Se abilities were very similar in composition to the three factors Kaufman had discovered for the entire standardization sample (i.e., Verbal Comprehension, Perceptual Organization, and FFD). Moreover, Kaufman's third factor was actually identical to Bannatyne's Se ability. Therefore, considerable support has been found for the construct validity of Bannatyne's abilities for Anglo children, with the exclusion of Acquired knowledge (Ak).

The first investigation of Bannatyne recategorized scores applied to Native Indian children was conducted by Zarske and Moore (1982a). They wanted to determine whether or not the recategorized score pattern of 192 learning disabled (LD) Navajo children would match the LD pattern for White children. Instead of the usual Sp > Cn > Se pattern however found for White LD children, a Sp > Se > Cn pattern was discovered. The pattern occurred with a greater than chance ($p < .01$) frequency, displaying significant differences among the ability scores at the .01 level. They thought they might have found a "Navajo LD Pattern". A subsequent study was needed however, using various control groups, to determine if the pattern was due to the presence of learning disabilities or ethnic differences.

When Zarske and Moore (1982b) observed the recategorized WISC-R score pattern for 452 non-handicapped (NH), learning disabled (LD), educationally disadvantaged (ED), and regular class (RC) Navajo children, the same Sp > Se > Ak > Cn pattern was evident for all. Therefore, the newly found pattern was of no use in differentiating LD Native children from other types of Native children. Of some use however was the finding that LD Navajo children scored lower than the other groups on the Sp and Se scores, though the overall pattern was the same. Finally, the Ak score was found to have some diagnostic utility.

That is, LD and ED Navajo children scored lower than RC and NH Navajo children in Ak ability.

Connelly (1983) examined the WISC-R recategorized score pattern of 145 Tlingit Native children from Southeastern Alaska. The so-called "Indian Pattern" (Sp > Se > Cn and Ak) was more readily seen in the older 11-16 year olds (i.e., 66%) than in the younger 6-10 year olds (i.e., 33%). These proportions were greater than that expected by chance (i.e., 8%). Nevertheless, of those showing the "Indian Pattern", only 8% of the older group and 2% of the younger group displayed significant ($p < .05$) differences among all three recategorized scores (i.e., Sp, Se, Cn). Therefore, the differences among the scores were not very large for most Tlingit children displaying the "Indian Pattern".

The recategorized WISC-R score pattern of 81 seven to thirteen year old Chippewa, Muncey (sic), and Oneida Native children in Ontario was investigated by Scaldwell et al. (1985). Neither a "disabled reader" nor a clear "Indian" pattern was evident. The Sp ability however was significantly higher than the other three abilities (i.e., Sp > Se = Cn = Ak). The relatively high Sp ability was interpreted as a Native strength in holistic, simultaneous and non-verbal processing as compared with a successive/sequential style of processing. The higher scores for Cn and Ak abilities may have resulted because the subjects were considered quite acculturated and used English as their primary language.

McShane and Plas (1982a) conducted the most sophisticated study of WISC-R recategorized score patterns with 52 referred Chippewa (Canada Ojibwa) and Sioux children using the WPPSI, WISC, and WISC-R tests. After grouping subjects into traditional (N=29) and acculturated (N=23) categories based on a Verbal-Performance IQ difference criterion of 9 points, they validated this split by using data from their Traditional Experience Scale (TES). The TES questionnaire was used as a measure of acculturation. It showed that highly traditional Native Indian mothers had children with the largest V-P IQ differences whereas low traditional mothers had children who did not exhibit a V-P IQ difference. The recategorization of WISC-R scores resulted in the following pattern (i.e., Sp > Se = Cn > Ak). Furthermore, this distinct pattern was only demonstrated by the traditional Native children, as defined by the TES questionnaire.

It is interesting to note that McShane and Plas (1982) came to the conclusion that their findings had established a unique "Indian Pattern" which they identified as Sp > Se > Cn > Ak. They did not however truly find this pattern if the statistical significance among the scores is included. Nor does this single pattern match patterns found in studies which used other cultural groups (e.g., Scaldwell et al., 1985; Zarske & Moore, 1982b). Even to say that they had established an "Indian Pattern" based on a limited number of tribal groups was a gross exaggeration. Moreover, their sample was not randomly selected. This hasty attempt to simplify reality may be creating an inaccurate stereotype. For example, one reviewer has already accepted this conclusion at face value by stating, "Their findings established an American Indian pattern of Spatial > Sequential > Conceptual > Acquired Knowledge categories" (Dana, 1984, p37). Furthermore, if McShane and Plas had examined the patterns of the Chippewa and Sioux subjects separately, they may not have been the same. It is much too soon to make any firm conclusions about an "Indian Pattern" which cuts across all tribal cultures. More research is needed.

Summary of Research and Implications

It is now well established that Native children generally perform below the norm on WISC-R Verbal Scale subtests. Physiological factors do not adequately explain the subaverage English verbal ability of Native children. Either the implicated diseases produce symptoms that are more severe than necessary (e.g., Minamata disease and Fetal Alcohol Syndrome) or they do not match the prevalence of the subaverage ability (e.g., Otitis Media). Neurological factors may explain which parts of the brain are responsible for the manifested learning style, but they do not explain how the processing differences originated. Socio-cultural factors are the most logically defensible causes of differential performance on the WISC-R for Native children. According to the Simultaneous-Successive Synthesis theory, socio-cultural factors can influence the style of neurological processing which produces the corresponding style of behavior. The tendency toward observational learning (Watch-Then-Do style) and imagery coding helps to explain the strength in spatial ability shown by Native children. Other factors such as (1) the amount of English spoken in the home, (b) the parent's belief in non-interference of the child,

(c) the degree of modesty, humility, non-assertiveness, and (d) the acceptability of silence when socializing may help to explain the subaverage Verbal subtest scores Native children obtain on the WISC-R.

Supplementing the WISC-R with "culture-fair" tests may not be any easier for Native children. They also do not tend to predict academic achievement as well as more verbally loaded tests such as the WISC-R. Using only the WISC-R's Performance Scale may mask poor results because of deficient English and a low degree of acculturation. The WISC-R Performance Scale subtests are also less useful in predicting academic achievement than are the Verbal Scale subtests. The use of the SOMPA may reduce overrepresentation of Native children in special education classes but it requires the construction of local norms and does not predict success in classrooms unless curricula incorporate Native cultural differences. Omitting biased WISC-R items is difficult because various tribal groups differ in which items are biased. The best overall adjustment for item-bias is to adopt Vernon's (1977) Information subtest items for Canadian Native children. Finally, translating the WISC-R into the Native child's traditional language is at best only feasible if he/she will be taught in the Native language.

Though McShane and Plas (1982a) claim to have established an "Indian Pattern" of recategorized WISC-R scores (i.e., Sp > Se > Cn > AK), these differences are not all statistically significant. Since McShane and Plas' (1982a) study really found a Sp > Se = Cn > AK pattern using a sample which included traditional Ojibwa subjects, other samples including traditional Ojibwa subjects may be expected to produce the same pattern. In addition, McShane and Plas' study is important because it demonstrates that the degree of acculturation is directly responsible for the presence or absence of a unique pattern of recategorized scores. It fails to identify however which Native cultural variables are most salient in predicting those scores associated with the pattern.

One problem in characterizing the Native child as having relatively lower sequential skills using the WISC-R is that most factor analytic studies fail to find a sequential factor on the WISC-R with Native children. That is, those WISC-R subtests (DS, CO, A) that measure sequential skills for White children do not usually measure these skills for Native children.

They may be incorrectly applying simultaneous skills to solve the sequential-type WISC-R subtests. Therefore, conclusions about Native children's sequential processing as measured on the WISC-R should be cross-validated with another instrument specifically designed to measure sequential skills (e.g., the K-ABC).

Statement of the Hypotheses

Based on the research questions asked and a review of the related literature, the following hypotheses were produced:

1. Seven to 12 year old Ojibwa Native children from a reservation school in southwestern Manitoba will display the following pattern of recategorized WISC-R scores: Sp > Se = Cn > AK.
2. A significant difference ($p < .05$) will be found between each recategorized WISC-R score in the obtained pattern, except for the Se and Cn scores.
3. At least some of the cultural variables as measured by the Native child and adult rating-scale questionnaires will significantly correlate with the obtained recategorized WISC-R scores.

4. A significant correlation of at least .70 will be obtained between the WISC-R sequential subtest (i.e., Digit Span, Arithmetic, Coding) scores and the K-ABC sequential processing subtest (i.e., Number Recall, Word Order, Hand Movements) scores.

Chapter III. Method

Subjects

The subjects used in this study were obtained from a population of 139 Ojibwa Native Indian children from grades two through seven at a band-operated reservation school in southwestern Manitoba, Canada.

The first stage of the sampling process involved asking the principal to consult with the teachers in grades two through seven, so that they could provide a list of students who were considered average performers. This resulted in a list of 56 students.

During the second stage, 40 students were identified from the initial list using stratified random sampling. The sample was stratified by age (7 - 9 year olds and 9 - 12 year olds) and gender (20 males and 20 females) to ensure a balanced representation of students. A table of random numbers was used to select the final sample. This was done by first numbering the boys and girls in each age group. Then, the author closed his eyes and randomly pointed to a starting number. As he moved along in a predetermined direction, he selected a subject if the number fell in the range previously listed. This was done for one gender and then the next until all 20 subjects for the younger group had been selected. The process was then repeated for the older group until all 40 subjects were chosen.

Characteristics of the sample may be seen in Table 2. As expected, most subjects fell within the Average range of ability. The mean Full Scale IQ was 91.52. Another point of interest was the large difference of 21.50 points between the mean Performance and Verbal Scale IQs. A large discrepancy like this has been seen in many previous studies (refer to Chapter I of this manuscript). Also of importance was that the majority of subjects spoke English most of the time. All of the subjects used English as their primary language at school, and 77% spoke mostly English at home. This analysis of English language usage can be seen in more detail by examining Table 3.

Table 2. Sample characteristics

Variable	Mean	Standard Deviation
Full Scale IQ	91.52	9.33
Verbal Scale IQ	82.55	10.48
Performance Scale IQ	103.50	11.29
V-P difference	21.50	11.84
Age	10.16	1.73

Table 3. English language usage at home

Rating	Frequency	Percentage
1. Never	1	2.5
2. Almost Never	1	2.5
3. Sometimes	7	17.5
4. Almost Always	14	35.0
5. Always	17	42.5

Four variables not used in the multiple regression analysis of this study were useful in comparing the subject traits with those found to be stereotypic of many Native Indian people. Each of these variables is contained within the Native Child Interview Questionnaire (see Appendix A) and has a scale range of five points. The first three of these were designed to measure the degree of modesty and humility supposedly characteristic of Native Indians (Everett et al., 1983). It was found that this sample of Ojibwa children tended to tell their mothers about good work in school (C5; mean = 4.13). They did not however habitually tell their friends about good work in school (C6; mean = 2.55). Finally, most indicated that they would provide an answer to a question posed by the teacher that their classmates did not know (C7; mean - 3.65). While item C6 corresponded to the stereotype, items C5 and C7 did not. It may be that for these subjects, the display of modesty is more contextually specific. For example, modesty may be confined to circumstances where significant adults (e.g., mother, teacher) are absent and only friends are present. The last of the four variables was designed to measure the degree of silence among friends, apparently more prevalent among Native Indian people (Kirkness, 1973). It was found that the majority thought it was okay to be quiet at times (C8; mean = 2.72) but most preferred to talk with their friends. Therefore, these children did not match the stereotype, at least from their own perspective.

Instruments

The instruments used in this study included the Wechsler Intelligence Scale for Children - Revised (WISC-R), the Kaufman Assessment Battery for Children (K-ABC), the Native Child Interview Questionnaire, the Native Adult Rating Form, and the Goodenough-Harris Drawing Test.

The WISC-R was selected because it has direct relevance to the research questions in this study. It was needed to obtain the recategorized scores previously mentioned. The WISC-R was developed by David Wechsler and published in 1974 by the Psychological Corporation (Wechsler, 1974). It is widely used in the United States for the assessment of ESL minority children, such as those of Native Indian descent (Nuttal, 1987). It is also used in Manitoba, Canada (McKlusky, personal communication, May, 1987; Williams, personal communication, June 9, 1987). It was standardized on 2,200 children in the U.S. between the ages of 6.0 and 16.11 years. The sample was stratified by race (i.e., White, Black, Oriental, Puerto-Rican, Mexican-American, and American Indian) in proportion to the U.S. population according to the 1970 census. The standardization sample however is mostly White. The WISC-R provides three types of deviation IQs each with a mean of 100 and standard deviation of 15. It provides a Verbal Scale IQ to represent the performance on Information, Similarities, Arithmetic, Vocabulary, and Comprehension subtests. Digit Span is optional in this scale. It provides a Performance Scale IQ to represent the abilities tapped by the Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding subtests. Mazes is optional on this scale.

Based on the Standardization sample, the internal consistency reliability for the Full Scale, Verbal Scale, and Performance Scale IQs are .96, .94, and .90 respectively across all age ranges. The mean test-retest reliability over a one month period based on a subsample of 303 children is .95, .93, and .90 for the Full Scale, Verbal Scale, and Performance Scale IQs respectively. Browne (1984) reported WISC-R subtest internal consistency reliabilities for South Dakota Indian children to range from .77 - .86 on the Verbal Scale to .70 - .85 on the Performance Scale. Mishra and Lord (1982) reported lower reliabilities for WISC-R subtests on a sample of 40 Navajo children from Arizona. Split-half reliability coefficients on the Verbal Scale subtests ranged from .46 - .79 and from .59 - .75 on the Performance Scale subtests. These are considerably lower than for the standardization sample.

Sattler (1982) reported the results of several concurrent validity studies. The 1972 Stanford Binet Intelligence Scale provides an IQ which is very similar to the WISC-R Full Scale IQ. The McCarthy Scales of Children's Abilities yields a general cognitive index (GCI) that is usually 6 points lower than the WISC-R on average. Finally, the Peabody Picture Vocabulary Test (PPVT) yields higher scores than the WISC-R by approximately 3 points with White children.

Naglieri and Yazzi (1983) found the opposite using 37 Navajo children. The mean WISC-R Verbal Scale IQ was 74.9 whereas the mean PPVT-R score was 61.1. The PPVT-R correlated highest with the WISC-R Verbal Scale IQ (i.e., .87). Since the subjects spoke primarily Navajo, it is no wonder they scored so low on the

PPVT-R, which is more a measure of receptive English vocabulary.

Naglieri (1984) found the following significant correlations between the WISC-R and K-ABC using a sample of 35 Navajo children: the K-ABC Simultaneous score correlated highest (.55) with the WISC-R Performance IQ; the K-ABC Achievement score correlated highest (.83) with the WISC-R Verbal IQ; and the K-ABC Sequential score correlated highest (.46) with the WISC-R Performance IQ. It seems counter-intuitive that the K-ABC Sequential score would correlate more with the WISC-R Performance Scale, since it is the WISC-R Verbal Scale that is supposed to measure more sequential-type abilities. One possible explanation for this may be due to the fact that Naglieri's (1984) subjects were from an isolated reservation in Arizona. As a result, they may have been used to dealing more with visual-spatial-simultaneous processing than with verbal-sequential processing. Since the WISC-R Performance Scale measures primarily the former type of processing, and since they scored higher on the WISC-R Performance Scale, they may have used this strength to try and solve the sequential processing problems. This then may have resulted in the higher correlation between the K-ABC Sequential Processing score and the WISC-R Performance Scale IQ.

With the same group of Navajo children, Naglieri (1984) found the WISC-R Verbal Scale IQ was the best predictor of achievement as measured by the Peabody Individual Achievement Test (PIAT). The correlation was .64 and was significant at the .05 level. Reschly and Reschly (1979) found the WISC-R Full Scale IQ was the best predictor of reading and mathematics performance on the Metropolitan Achievement Test (MAT) for a sample of 202 Papago children. Significant ($p<.01$) correlations of .41 and .43 were obtained for reading and mathematics respectively. St. John and Krichev (1976) sampled 100 Ojibwa and Cree Native children from Ontario. They found significant ($P<.005$) correlations of .54 and .67 between end-of-year academic grades and WISC-R Verbal and Performance IQs respectively. McCullough et al. (1985) found the WISC-R useful in predicting reading and mathematics achievement for Yakima Native children from Washington State. Significant correlations of .61 and .68 were found between the STEP mean reading score and the Verbal and Full Scale IQs respectively. In terms of mathematics achievement, significant correlations of -

.40 and .38 were found for the Performance and Verbal IQs respectively. The K-ABC was selected for this study to cross-validate the WISC-R's Sequential subtest scores. The K-ABC was developed by Alan and Nadeen Kaufman and is based on Luria's theory of simultaneous and sequential brain processes (Kaufman & Kaufman, 1983). It is published by the American Guidance Service and is appropriate for children 2 1/2 to 12 1/2 years of age. Only the Sequential Processing scale was needed in this study. This scale includes three subtests. One is called Hand Movements, which measures visual sequential processing. Basically, the child must copy the hand movements of the examiner in the same sequence modeled. Another of these subtests is called Number Recall, which measures auditory/verbal sequential processing. Here, the child must repeat series of digits in the same sequence as the examiner. The last subtest is called Word Order, which also involves auditory sequential processing. The child must touch series of picture silhouettes in the same sequence as verbalized by the examiner.

Kaufman and Kaufman (1983) report concurrent validity results which found the K-ABC Achievement Scale correlated quite well with the WISC-R FSIQ (i.e., .80) using a sample of 40 Sioux children from South Dakota. Naglieri (1984) found a similar correlation (i.e., .78) with their Navajo sample. Kaufman and McLean (1987) found that the three-factor solution of the K-ABC supporting its construct validity was maintained using a sample composed of 154 Whites, 9 Blacks, 9 Asians, and 40 Sioux Indians. The three-factor solution includes an Achievement factor, a Sequential Processing factor, and a Simultaneous Processing factor. Naglieri's (1984) Navajo sample was far better in simultaneous processing than in sequential processing. On the other hand, Kaufman and McLean's (1987) sample which included Sioux Indians were roughly equivalent in these two modes of processing. One explanation for the difference between these two Native Indian cultures is that Naglieri's (1984) sample did not require the use of as much sequential processing because they came from an isolated reservation. Alternatively, Kaufman and

McLean's (1987) sample of Sioux Indians was quite integrated and acculurated to the majority culture, where sequential processing is more necessary. Another explanation for the difference may be because of the pooling of different ethnic groups in Kaufman and McLean's (1987) study. This may have masked the superiority in simultaneous processing that the Sioux Indians might also have had. Finally, Naglieri's (1984) study supported the predictive validity of the K-ABC. They found a correlation of .82 between the K-ABC Achievement Scale and the Peabody Individual Achievement Test (PIAT). In fact, the K-ABC was a better predictor of achievement for Navajo children than was the WISC-R, in which the highest correlation with the PIAT was only .64.

The Draw-A-Man subtest of the Goodenough-Harris Drawing Test was selected simply to facilitate rapport with the Native children. This test was designed by Dale Harris and published by the Psychological Corporation in 1963 (Harris, 1963). The 1950 standardization sample included 2,975 U.S. children between the ages of 5 and 15. The test normally asks the child to draw three pictures: a man, a woman, and a self-portrait. This study's application required only that each child draw a man. Young children require a maximum of 10 to 15 minutes to complete the three drawings. It was believed that this test would set the children at ease by starting off the testing session with a task which capitalized on their assumed strength in visual coding and simultaneous processing. Since the test scores were not used, the reliability and validity of this instrument were not reviewed.

In order to study how Ojibwa culture influences the performance of Ojibwa children on the WISC-R, an instrument was needed that would sample the salient variables that differentiate between Native Indian people and those in the Anglo-majority culture. The literature had shown the following characteristics to be important in this regard: a tendency toward observational rather than trial and error learning (Kaulback, 1984; More, 1987; Spence, 1973); the amount of English spoken in the home (Everett et al., 1983; McShane, 1980); the parent's belief in non-interference of the child (Everett et al., 1983; Pelletier, 1974; Sealey, 1980); the acceptability of silence when socializing (Kirkness, 1973); a tendency toward imagery coding rather than verbal coding (More, 1987); and an inclination toward modesty, humility, and non-assertiveness (Everett et al., 1983; Rivais, 1985). Unfortunately, before the study was undertaken, a published instrument that would measure these traits could not be found. Therefore, it was decided that the appropriate data collection method would have to be constructed.

At first, an instrument that would measure these traits only in the children was considered necessary. However, it was later thought that the children might not be as aware of their cultural influences as would be their parents. And, since their parents are a primary source of cultural transmission, it was considered desirable to measure these traits in the parents as well. Therefore, two instruments were designed. Each utilized a rating scale with the intention that they would capture the many shades or levels of each variable. Furthermore, each scale maximized the number of gradations to prevent the likelihood of a restricted range of scores, known to artificially reduce the reliability of an instrument (Anastasi, 1982).

The Native Adult Rating Form was designed to be completed by each child's primary parent or guardian (i.e., the one who looked after the child the most).

It was composed of five items using a Semantic-Differential style format. This was used to capitalize on the Native person's strength in imagery coding (More, 1987) by providing a visual-looking choice. Also, each item was framed in a statement rather than a question form, since the literature indicated Native Indian people do not favor questions (Everett, et al., 1983). Responding to each item involved placing an (x) above a number from one to seven that best reflected the parent's values. An example of this form can be found in Appendix A.

The Native Child Interview Questionnaire was designed to be used in an interview between the child and the examiner. For each of the 10 questions posed, the child had to decide how often he/she did what was asked. A five-point Likert-type scale was provided, which although shorter than the seven-point adult scale, was thought to be developmentally appropriate. Before questioning, a 3 x 5 inch card was given to the subject. It included the five response category labels at the top (i.e., never, almost never, sometimes, almost always, and always) and a shaded bar graph underneath each label to visually represent quantity. The five-point rating system was explained to the child using this card as a visual aid, and formal questioning did not begin until the examiner was confident that the child understood. After each question, the examiner recorded the child's rating on the questionnaire by placing a check mark above the word(s) that matched the child's answer. A sample of this instrument can be found in Appendix B.

Ideally, extensive reliability and validity information should have been collected on these instruments before using them. This would normally involve randomly selecting a subgroup of individuals from the sample of 40 children and their parents. Next, the items would be tried out with this subgroup and posttest interviewing could provide information about how they interpreted the items. Any items not functioning as intended would be discarded and better ones would be constructed. This process would continue until the pool of items functioned as they were intended to. Finally, test-retest reliability could be ascertained by administering the instruments twice with some appreciable time in between testing, and then getting a correlation between the two sets of scores. Unfortunately, because the reservation used was quite a distance away, and because of time and monetary constraints, this elaborate process could not be carried out.

Instead, before the study began, the two developed instruments were field-tested on a sample of five Native Treaty Indian children and their parents from Winnipeg, Manitoba. After testing, the children and parents were asked if the questions were clear and understandable. All these people agreed that the items were fairly straight forward. When asked if there were any they would change, they indicated that they could not make them any clearer. Therefore, the usability of the instruments was judged to be adequate. In terms of validity, only content validity was appreciably dealt with.

Design

This study was essentially correlational in design using one representative group. Of major interest was the correlation of cultural variables with the obtained pattern of recategorized WISC-R scores. Additionally, the correlation of the WISC-R Sequential subtest scores with the K-ABC Sequential subtest scores was used to cross-validate the recategorized WISC-R Sequential score.

Procedure

Authorization to conduct this study at the reservation school was secured through the school principal and local school board.

Before the data collection began, the Native Child Interview Questionnaire and the Native Adult Rating Form were field-tested for usability and item validity (refer to the Instruments section).

After the 40 subjects were randomly selected (refer to the Subjects section), the parents of these children were forwarded a letter of consent delivered by the school principal. Briefly, it described the nature of the study, estimated time required of them and their children, assurance of confidentiality of results, the right to withdraw without penalty, and the aggregated feedback to the teachers of selected students. A sample of this letter of consent may be seen in Appendix C.

Parents who signed the letter were immediately given the Native Adult Rating Form by the school principal. Only three parents declined participation in the study. As a result of this, further random sampling was done and the remaining three consent forms were signed.

Testing was carried out by seven school psychology graduate students as well as the author. The seven students participated in the study as part of their course requirements in an Advanced Testing and Measurements course (43.710) offered by the Department of Educational Psychology at the University of Manitoba. The author of this study helped to train these students in the administration of all the instruments used. The students were instructed to administer the WISC-R using Vernon's (1977) suggested changes to the Information subtest. The course professor (the author's advisor), who had a Ph.D. in Clinical Psychology, supervised the project and was available for consultation. After approximately 20 hours of training (which included administration of the test battery on a seven year old Native Indian girl), the author was confident that the other graduate students had reached a suitable level of competency in administering the instruments. At this point, the graduate students were given an outline of the testing procedure, a list of the necessary materials each should have, and large brown envelopes containing data sheets, pencils, pencil sharpeners, 3 x 5 inch visual aid cards, and sticker prizes. In addition, each graduate student was provided with all the necessary instruments (e.g., WISC-R, K-ABC, etc.).

Testing was carried out at the reservation school, beginning during the middle of November 1987 until the end of January, 1988. The seven graduate students who helped out, collected data on a total of 24 subjects. The remaining 16 subjects were tested by the author. The testing was conducted in a quiet area of the school, which was off limits to the rest of the student body. The area had several individual rooms which allowed for privacy.

Each testing session began with five minutes of rapport building between the examiner and child. This was followed by the administration of the Draw-A-Man test, which took approximately 10 minutes to complete. Next, the child was administered the three sequential processing subtests of the K-ABC, which took about another 10 minutes. Following this, 11 subtests of the WISC-R were administered, excluding Mazes. This took approximately 90 minutes. Midway through this, the examiner and child took a break for about 10 - 15 minutes. During this time, the child was provided with juice and various snacks. After the WISC-R, the child was given the 3 x 5 inch visual aid while he/she was given an explanation of the five-point rating scale. Then, the child was administered the Native Child Interview Questionnaire, which took another 10 minutes. In total, a maximum of 2 1/2 hours was allowed for each child to complete the test battery.

Data Analysis

Once the data was collected, all of the test protocols were scored by the author and the other graduate students. Then the author went over all the protocols a second time to ensure correct scoring. Only minor revisions were necessary.

Then the WISC-R subtest scaled scores were recategorized according to the system proposed by Bannatyne (1974). This resulted in four derived scores per subject (i.e., Spatial (Sp), Sequential (Se), Conceptual (Cn), and Acquired Knowledge (AK)) each of which was composed of three specific subtest scaled scores, having a mean scaled score total of 30 points. To reiterate, the Sp score was composed of the Picture Completion, Block Design, and Object Assembly subtest scaled scores. The Se score was composed of the Arithmetic, Digit Span, and Coding subtest scaled scores. The Cn score included the Similarities, Vocabulary, and Comprehension subtest scaled scores.

And, the AK score comprised the Information, Arithmetic, and Vocabulary subtest scaled scores.

Next, the K-ABC Sequential Processing subtest scaled scores were added together for each subject. This involved adding the scaled scores from the following subtests: Hand Movements, Number Recall, and Word Order. Each derived score had a mean of 30 points, like the recategorized WISC-R scores.

Analysis of the raw data was done using Statistical Analysis System (SAS) software (SAS Institute Inc., 1985) on the University of Manitoba's main-frame computer. After creating a SAS data set, the following variables were inputted: the subject's number; the subject's age; the subject's sex; the Verbal-Performance Scale IQ difference; the Sp, Se, Cn, and AK WISC-R scores; the K-ABC Sequential Processing score; questions 1, 2, 3, 9, and 10 from the Native Child Interview Questionnaire; items 1, 2, 3, 4, and 5 from the Native Adult Rating Form; the WISC-R Verbal Scale IQ; the WISC-R Performance Scale IQ; the WISC-R Full Scale IQ; the K-ABC auditory sequential processing score; and the WISC-R auditory sequential processing score. The raw data may be seen in Appendix D.

To test the first hypothesis that the obtained WISC-R pattern would be Sp > Se = Cn > AK, the mean of each score was computed using SAS's PROC MEANS procedure. Then, the scores were rank ordered from left to right starting with the highest mean score.

To test the second hypothesis that a significant difference ($p < .05$) would be found between each recategorized WISC-R score in the obtained pattern, except for the Se and Cn scores, a SAS software PROC GLM repeated measures analysis of variance (ANOVA) was used, along with a .05 alpha level. This type of comparative analysis is typically done when several measurements are taken on the same person (SAS Institute Inc., 1985). The most important advantage of using this method is that the subject error variance is controlled and separated from the error term (Pedhazur, 1982). This in turn increases the power of the test to detect differences among the means (Keppel & Saufley, 1980). Specific comparisons between the means were made using linear contrasts which are part of the REPEATED statement in PROC GLM.

Once a pattern was established using PROC GLM, it was considered desirable to determine what percentage of the sample exhibited the pattern. Furthermore, the percentage of the sample displaying certain portions of the pattern was examined to enhance theoretical interpretations. These calculations were done by hand, and they can be seen in Appendix E.

To test the third hypothesis that at least some of the 15 cultural variables would significantly predict the obtained pattern of recategorized WISC-R scores, a stepwise multiple regression was performed. Initially, when the questionnaires were designed, it was expected that 64 subjects to 15 independent variables was roughly four to one, a minimum ratio suggested by Tabachnick and Fidell (1983). However, because of shortages in personnel, time, and funding, the final number of subjects sampled was 40. Therefore, to maintain the suggested ratio, the number of independent variables entered into the stepwise procedure was reduced to 10. The discarded variables were all from the Native Child Interview Questionnaire for the following reasons: (a) question C.4. was the exact opposite of question C.3. and would therefore be perfectly correlated, leading to multicollinearity (see below for a discussion of this concept); (b) the other four variables were not as closely associated with this study's theoretical framework; and (c) responses from the child questionnaire were believed to be less reliable than responses from the adult questionnaire, since children are less introspective than adults.

The stepwise method was chosen over the Maximum R^2 improvement, Minimum R^2 improvement, and the RSQUARE procedures because these procedures do not use significance levels for inclusion or deletion of variables as in the stepwise option of PROC STEPWISE (SAS Institute Inc., 1985; Younger, 1985). This is important if one is to conclude that the increase in R^2 (the multiple coefficient of determination) is large enough at each step of the model building to justify including another variable. Furthermore, the other techniques do not try to find the one best model that predicts the dependent variable. Rather, they produce the best one variable model, then the best two variable models, and so on. Since this study was exploratory in nature, it did not have any a priori assumptions about exactly how many variables should be included in the model. Only the one best model was desired for each WISC-R recategorized score. SAS also allows one to force certain variables into the model. Since there was no theoretical justification for doing this, this option was not employed.

The stepwise option of SAS's PROC STEPWISE was also chosen over the forward variable-selection option because it allows more flexibility in variable selection. Once the forward selection procedure adds a variable to the model, based on a partial F-value at the specified significance level, it cannot be removed even when other added variables make it superfluous by lowering its relative partial F-value (Younger, 1985). The stepwise procedure, on the other hand, allows for the removal of any superfluous variables after they have been entered into the model, and these are eligible for reinclusion at a later step (Younger, 1985). With the backward elimination procedure, once a variable is removed, it cannot be entered again (Younger, 1985). This problem is similar to the forward selection procedure previously mentioned. Therefore, the stepwise procedure was considered the best option for this study.

The standard or SAS default significance level of .15 was used with the stepwise procedure. One may wonder why a smaller significance level like alpha = .05 was not selected as the criterion for entry into the model, to prevent Type I errors. One reason is that such a small alpha level would prevent variables from having a chance to enter the model and decrease the error variation due to omitted predictors (Younger, 1985). Moreover, Bendel and Afifi (1977) found the .15 alpha level to be the best stopping rule for sequential partial F-tests used in stepwise regression especially for the degrees of freedom used in this study (i.e., df = (n-p) or (40-10) = 30).

Once the multiple regression models were obtained, the possibility of multicollinearity was explored. Multicollinearity has been defined as ". . . a high degree of multiple correlation among several variables" (Freund & Littell, 1986, p.75). According to Younger (1985), "When multicollinearity is present, the net regression coefficients are said to be <u>unreliable</u> measures of the effects of their associated predictor variables; they not only measure the effect of the related predictor but are confounded with the effects of other predictors related to it" (p.407).

There are several ways of attempting to detect multicollinearity. One, is to examine the signs of the regression coefficients. If they are the opposite of what one would expect, multicollinearity may be present (Berenson, Levine, & Goldstein, 1983). Also, if regression coefficients have large standard errors, this may be another indication (Berenson et al., 1983). Another common method is to examine the correlation matrix produced from the variables used in the study. According to Berenson et al. (1983) "Large correlations point to strong linear associations, implying that certain variables may be surrogates for others with little or no effect as predictors themselves" (p.415). This procedure was carried out for this study using SAS's PROC CORR to create a correlation matrix. Then the magnitude of the correlations was examined. Finally, a procedure outlined by Freund and Littell (1986) dictates that Variance Inflation Factor (VIF) values be calculated for each independent variable in a model. Each value is then compared to the VIF critical value to determine if multicollinearity is present. If a variable's value exceeds the VIF critical value, that variable is likely involved in a multicollinearity. This procedure was generated using the VIF option of SAS's PROC REG procedure. The VIF critical value was calculated using the following formula: $1/(1-R^2) = VIF$.

To test the last hypothesis that a significant correlation of at least .70 would be found between the WISC-R sequential subtest scores and the K-ABC sequential processing subtest scores, a Pearson correlation was carried out using SAS's PROC CORR.

After the data were collected, strong evidence was found to suggest that the WISC-R Coding subtest does not load on the sequential factor (Kaufman & McLean, 1987). For this reason, the Coding scores were removed from the recategorized WISC-R Sequential score, so that a purer WISC-R Sequential score could be correlated with its K-ABC equivalent. This correlation was again performed using SAS's PROC CORR. The results of this correlation may be found in the Discussion section.

Chapter IV. Results

Results of Hypothesis I

The means of each WISC-R recategorized scaled score and the standard deviations are shown in Table 4 below.

Table 4. Means and standard deviations of the WISC-R recategorized scaled scores.

WISC-R Recategorized Scores		Mean	Standard Deviation
Spatial	(Sp)	34.22	5.41
Sequential	(Se)	24.22	5.16
Acquired Knowledge	(AK)	22.10	5.09
Conceptual	(Cn)	19.97	5.79

After examining the means, it was found that the pattern of scores was as follows: Sp > Se > AK > Cn. Therefore, the results did not match the expectation of hypothesis I that the pattern would look like Sp > Se = Cn > AK. Nevertheless, examining only the relative magnitude of the means was not conclusive evidence that some of the variation among the scores was unaffected by chance. Therefore, a test of the statistical significance among the scores was needed.

Results of Hypothesis II

The second hypothesis predicted that there would be a significant difference ($p < .05$) between each recategorized WISC-R score in the obtained pattern, except for the Se and Cn scores. This hypothesis was not supported, since the differences among all the scores were statistically significant. These findings supported the conclusion that the obtained pattern (i.e., Sp > Se > AK > Cn) was not due to chance. The results of the repeated measures ANOVA contrasts are shown in Table 5.

Table 5. Results of the Repeated Measures ANOVA Contrasts Among the WISC-R Recategorized Scores

Score Relationships	F - Value
Sp > Se	136.13
Sp > AK	153.27
Sp > Cn	226.67
Se > AK	6.17
Se > Cn	15.10
AK > Cn	9.12

Note: All comparisons were significant at the .05 level. Furthermore, each comparison had the following degrees of freedom (df) = (1, 39).

As an extension of Hypothesis II, the percentage of sample subjects who displayed the obtained pattern and portions thereof were examined for theoretical as well as practical reasons. These findings are shown in Table 6 below.

Table 6. Percentage of Subjects Who Exhibited The Obtained WISC-R Recategorized Score Pattern and Portions Thereof

Score Relationships	Percentage
Sp > Se	95
Sp > Se > Cn	68
Sp > Se > AK	53
Sp > Se > AK > Cn	30

As can be seen in Table 6, only 30 percent of the sample displayed the whole WISC-R recategorized score pattern. Therefore, the entire pattern is not representative of the majority of subjects. Nor is it likely representative of the population from which the sample was derived. What can be concluded, is that for the majority of subjects, spatial ability was greater than sequential ability, which in turn was greater than verbal ability (i.e., either AK or Cn).

Results of Hypothesis III

The third hypothesis predicted that some of the cultural variables from the Native child and adult rating-scale questionnaires would significantly correlate with the obtained recategorized WISC-R scores. This hypothesis was confirmed by the results of the stepwise multiple regression procedure. Three out of the four recategorized WISC-R scores had cultural variables that were significantly correlated with them. The only recategorized WISC-R score that was not associated with any of the cultural variables was the Se score. The results of the stepwise procedure are displayed in Table 7.

As seen in Table 7, two variables from the Native Adult Rating Scale correlated with the recategorized WISC-R Spatial scores: parental thinking style, and the parent's level of talk when socializing. These two variables accounted for 14 percent of the variation in the Ojibwa childrens' WISC-R Spatial scores. Four variables accounted for 31 percent of the variation in WISC-R Acquired Knowledge scores. These included (a) the amount of English spoken by the child at home, (b) the child's level of covert verbalization when remembering stories, (c) the parent's language preference at home, and (d) the parent's childrearing style (i.e., preventing mistakes vs. allowing mistakes). Finally, the WISC-R Conceptual score was significantly correlated with five cultural variables: (a) the child's perception of his/her expected level of independence and responsibility, (b) the amount of English spoken by the child at home, (c) the child's level of covert verbalization when remembering stories, (d) the parent's learning style (i.e., trial and error vs. observation), and (e) the parent's level of talk when socializing.

Table 7. Results of the SAS Stepwise Regression Procedure

Dependent Variable	Predictor Variables	Partial R[2]	F Value	Exact Probability
1. WISC-R Spatial score	A1 Thinking style	0.09	3.63	0.0642
	A5 Level of talk when socializing	0.05	2.25	0.1421
		0.14		
2. WISC-R Acquired Knowledge score	C3 Amount of English spoken	0.09	3.91	0.0554
	C9 Level of covert verbal-ization	0.06	2.66	0.1115
	A3 Language preference at home	0.07	3.37	0.0749
	A4 Child-rearing style	0.09	4.22	0.0471
		0.31		
3. WISC-R Conceptual score	C2 Level of independ-ence	0.07	3.33	0.0765
	C3 Amount of English spoken	0.12	5.12	0.0295
	C9 Level of covert verbal-ization	0.08	3.85	0.0574
	A2 Learning style	0.07	3.79	0.0600
	A5 Level of talk when social-izing	0.04	2.19	0.1482
		0.38		
4. WISC-R Sequential score - Nil				

In order to more closely examine the relationships between the cultural variables and the recategorized WISC-R scores, the direction of the correlations were ascertained. These correlations are shown in Table 8.

Both correlations between the WISC-R Spatial score and the two cultural variables associated with it had negative signs. This meant that the child's Spatial score was higher under the following conditions: (a) the more the parent used covert verbalization rather than covert visualization, and (b) the more the parent talked when socializing.

Table 8 also clarified the relationships between the WISC-R Acquired Knowledge score and its associated cultural variables. It was found that the child's Acquired Knowledge score was higher under these circumstances: (a) the more the child spoke English rather than Ojibwa at home, (b) the more the child used covert verbalization when remembering stories, (c) the more the parent spoke English rather than Ojibwa at home, and (d) the more the parent allowed the child to learn from his/her own mistakes.

Table 8. Correlations between the Cultural Variables and the Recategorized WISC-R Scores

Recategorized WISC-R Scores		Cultural Variables	Correlations
Spatial	A1	Thinking style	-0.30
	A5	Level of talk when socializing	-0.23
Acquired Knowledge	C3	Amount of English spoken	0.31
	C9	Level of covert verbalization	0.15
	A3	Language preference	-0.21
	A4	Childrearing style	0.27
Conceptual	C2	Level of independence	0.06
	C3	Amount of English spoken	0.34
	C9	Level of covert verbalization	0.20
	A2	Learning style	0.14
	A5	Level of talk when socializing	-0.17

Finally, the child's WISC-R Conceptual score was higher under these conditions: (a) the more the child perceived that mother expected him/her to be independent, (b) the more the child spoke English rather than Ojibwa at home, (c) the more the child used covert verbalization when remembering stories, (d) the more observational the parent's style of learning, and (e) the more the parent spoke when socializing.

To ensure that the stepwise multiple regression was not affected by multicollinearity, the correlation matrix which included all the correlations among the recategorized WISC-R scores and cultural variables was examined. None of the correlations exceeded 0.30 except for one, however this correlation was only moderately high (i.e., 0.60). It occurred between variables A1 (thinking style) and A4 (childrearing style). This correlation did not appear large enough to be of concern. The correlation matrix is shown in Appendix F.

The next step in assessing the presence of multicollinearity was to examine the VIF values of each variable in each regression model. In every case, none of the variables exceeded the VIF critical value. This supported the absence of multicollinearity. These results may be seen in Appendix G.

Results of Hypothesis IV

The fourth hypothesis predicted that a significant correlation of at least 0.70 would be found between the WISC-R and K-ABC Sequential scores. This hypothesis was not supported as the correlation was only 0.52. This meant that the K-ABC Sequential Processing scores accounted for only 28 percent of the variation in WISC-R Sequential scores.

Chapter V. Discussion

The purpose of this study was first of all to determine the pattern of four recategorized WISC-R scores for Ojibwa children in southwestern Manitoba. The pattern that resulted was Sp > Se > AK > Cn, which did not confirm hypothesis I that the pattern would be equivalent to the one found by McShane and Plas (1982a). The difference may have resulted because even though McShane and Plas used a similar cultural group (i.e., over 66% were Ojibwa children from the United States), the obtained pattern may have been confounded by the presence of Sioux children in their sample.

The pattern from the present study was also found to be stable. That is, the differences among the scores were not due to chance. This did not confirm hypothesis II that there would be no significant difference between the Se and Cn scores as McShane and Plas (1982a) had found. On the other hand, the pattern found in the present study was the same pattern found by Zarske and Moore (1982b) for Navajo children whose primary language was Navajo. The primary language for subjects in the present study however was English. Therefore, the use of English as a second language does not explain why the Ojibwa subjects in the present study had the same pattern as the Navajo subjects. It may be however that there are similar cultural elements shared by these two tribal groups which produced the pattern.

Although the relative magnitude of the mean recategorized WISC-R subtest scores was more probable than a chance occurrence, only 30 percent of the subjects in this study exhibited the average pattern. No prior study has explored the percentage proportion for a pattern composed of all four of the Bannatyne scores. Connelly (1983) performed a similar analysis for his sample of Tlingit Native children, but only looked at the proportion of children displaying patterns composed of three of the Bannatyne scores. For example, it was found that 61 percent of the 11 to 16 year olds manifested either the Sp > Se > Cn or Sp > Se > AK pattern. The present study found 68 percent of the sample displayed the Sp > Se > Cn pattern, while 53 percent showed the Sp > Se > AK pattern. If the percentages for these two patterns are averaged, the resulting figure is also 61 percent, as Connelly (1983) had found for his sample of Tlingit Native children.

Based on the above findings, it is more accurate and representative to conclude that the Ojibwa pattern of recategorized WISC-R scores is Sp > Se > AK and Cn. Yet, this pattern is not unique to Ojibwa children from southwestern Manitoba because it has been found with Tlingit and Navajo children (Connelly, 1983; Zarske & Moore, 1982b). Again, it may be that there are similar cultural elements shared among Ojibwa, Tlingit, and Navajo tribes which account for the pattern. For example, each of these cultural groups came from a relatively isolated rural community. This type of cultural setting is very different than that of the complex urban middle-class setting of the majority culture.

The most prevalent pattern found in this study and others was Sp > Se ability. This relationship was found among 95 percent of the children in the sample. There are no prior studies which have determined the percentage of subjects who displayed this pattern. McShane and Plas (1982a) did find however that 93 percent of the traditional WISC-R group had Sp ability as the highest of the four scores. Conversely, only 63 percent of the acculturated WISC-R group had Sp ability as the highest score. The Sp > Se pattern appears to be representative of most Native Indian children regardless of tribal affiliation. For example, it has been found in Navajo (Zarske & Moor, 1982a; 1982b), Chippewa (U.S. Ojibwa) (McShane & Plas, 1982a; Scaldwell et al., 1985) Tlingit (Connelly, 1983), Sioux (McShane & Plas, 1982a), Oneida (Scaldwell et al., 1985), and now Canadian Ojibwa children in Manitoba. This suggests that Native Indian children have a strength in simultaneous processing as opposed to successive or sequential processing.

Some research has already been found to support a simultaneous > successive learning style among Native Indian children from reservations. For example, Krywaniuk (cited in More, 1987) found that grade 3 Native children scored higher on measures of simultaneous processing and lower on measures of successive processing than an equivalent group of White children, though the overall ability score was equivalent. The factor structure of the tests (i.e., simultaneous vs. successive) was the same for both Native and White subjects however the different subtest loadings indicated that the Native children were not applying the same strategies as the White children. A subsequent study by Krywaniuk and Das (1976) using a sample of 40 Native students in grades 3 and 4 at Ermineskin School in Hobbema, Alberta, found similar results. Kaufman and Kaufman (1983b) reported comparable results in the K-ABC Interpretive Manual for a group of traditional Navajo children who received the instructions in their own native language. On the other hand, a group of 40 Sioux children who spoke English well and were integrated into the regular public schools did not show the simultaneous > successive learning style (Kaufman & Kaufman, 1983b). Comparing the latter study to the others before it seems to suggest that there is something about living on an isolated reservation or coming from a more traditional culture that produces a simultaneous > successive learning style among Native Indian children.

Though the K-ABC and other instruments such as those created by Das have helped to establish a simultaneous > successive learning style among some Native Indian children, the question still remains as to whether the WISC-R measures these two modes of processing. A recent study by Kaufman and McLean (1987) provides some evidence that certain WISC-R subtests do in fact measure these processing modes. Their sample of 212 subjects between the ages of 6 and 12.6 years was composed of four ethnic groups: 154 Whites, 9 Blacks, 9 Asians, and 40 Sioux Indians.

After a separate factor analysis of the WISC-R and K-ABC confirmed the three-factor solutions found earlier, they performed a joint WISC-R/K-ABC factor analysis. It was found that the WISC-R Verbal Scale subtests loaded on the Achievement factor. The WISC-R Performance Scale subtests loaded on the Simultaneous factor. And, the WISC-R Arithmetic and Digit Span subtests significantly loaded on the Sequential factor. This latter finding is especially important because it appears that the subtests comprising Bannatyne's Sequential ability do not all measure sequential or successive processing. In particular, it is unlikely that the WISC-R Coding subtest measures this ability. When Kaufman and McLean (1987) correlated the WISC-R Freedom From Distractibility (Bannatyne's) scores with the K-ABC Sequential Processing scores a correlation of 0.52 resulted. The present study also did a correlation of this sort. The correlation coefficient was also 0.52. This means that the WISC-R Sequential ability scores account for only 27 percent of the variance in the K-ABC Sequential scores. Interpreted another way, roughly 1/4 of the variance in Bannatyne Sequential ability scores can be attributed to the use of sequential or successive processing.

Since it was found post hoc that the Coding subtest does not likely measure sequential processing, a supplementary analysis was performed to determine how well the remaining WISC-R subtests (i.e., Arithmetic and Digit Span) would correlate with the K-ABC Sequential Processing scores. It was found that the correlation increased from 0.52 to 0.58. Therefore, roughly 1/3 (i.e., 34%) of the variance in the refined WISC-R Sequential ability scores can be attributed to the use of sequential processing through the auditory channel.

So what is being measured for the other 2/3 of the variance? This is where speculation begins. Since Kaufman and McLean (1987) found the WISC-R Arithmetic scores to load on the Verbal-Achievement factor, this may account for some of the variation. Other factors being measured may include attention, concentration, and distractibility (Sattler, 1982). These factors are associated primarily with the reticular formation at the top of the brain stem which has intimate connections with the frontal lobes (Luria, 1973). This is an important point because as Luria (1973) states, ". . . the prefrontal cortex plays an essential role in regulating the state of activity, changing it in accordance with man's complex intentions and plans formulated with the aid of speech" (p.86). He also asserted that "higher mental processes are formed and take place on the basis of speech activity" (Luria, 1973, pp.93-94). Thus, the frontal lobe regulates the attention and concentration of the brain through the use of speech, which stimulates and modulates the electro-chemical activity of the reticular formation, which in turn regulates the optimal cortical tone needed for focused goal-oriented behavior. Therefore, the 2/3 of the variance in the refined WISC-R Sequential ability scores not accounted for by the use of sequential processing may be accounted for by the metacognitive processing of the brain's frontal lobe.

Relating these processes to Das et al.'s (1975) Simultaneous and Successive Synthesis theoretical model, it can be said that they all fall within the domain of the central processing unit (refer to Figure 1). The present study as well as others has shown that traditional Native Indian children have a relative superiority in simultaneous processing. This processing is done within the Parietal-Occipital lobes of the brain. In addition, the present study along with others has provided evidence that traditional

Native Indian children have a relative weakness in sequential or successive processing. This processing is done within the Fronto-Temporal lobes of the brain. Since the WISC-R Sequential score may also be measuring attention, concentration, and distractibility, it has been postulated that metacognitive/regulatory functions may be lacking. These processes according to Luria (1973) are involved with the feedback loop between the frontal lobes and the reticular formation.

These proposed weaknesses in sequential processing and metacognitive regulation are not meant to imply that Native Indian children have some sort of brain damage. On the contrary, both may be explained by the cultural differences between traditional Native Indian children living on reservations and those who are well integrated into the Anglo-majority culture. For example, evidence has already been provided that the 40 Sioux Indians as reported in the K-ABC Interpretive Manual (Kaufman & Kaufman, 1983b) who were well integrated into the majority culture did not display a relative weakness in sequential processing. Only studies using traditional Native Indian children who lived on reservations showed this (e.g., Kaufman & Kaufman, 1983b; Krywaniuk & Das, 1976; More, 1987).

Regarding the weakness in metacognitive processes, the present study has found some evidence to support this. However, an examination of how these metacognitive (frontal lobe) processes come to regulate behavior will provide a better understanding of how the evidence supports a deficiency in these processes.

Metacognitive regulation of behavior, according to Vygotsky, develops out of the intimate social bond between mother and child (Luria, 1982). It begins when the child starts to execute the mother's commands. Luria (1982) summarized this early ontogenesis:

> Labeling by the mother and her pointing gesture focus the child's attention. These communicative behaviors single out an object from several equally attractive things in the environment. Consequently, the child's attention ceases to obey the rules of natural patterned reflexes and begins to be subordinated to the adult's speech. (p.90)

According to Schunk (1986), Luria built on Vygotsky's work and postulated three stages in the development of verbal (metacognitive) control of behavior. First, between the ages of 1.5 to 2.5, the speech of others is primarily responsible for regulating the child's behavior. Next, between the ages of 3 to 4, the child's overt verbalizations can initiate motor behaviors but cannot inhibit them. Finally, between the ages of 4.5 to 5.5, the child's overt private speech becomes capable of initiating, directing, and inhibiting motor behaviors. Beyond this starting point, overt verbalization (i.e., thinking aloud) increases until the age of 6 or 7. After this it starts to decline and becomes primarily covert between the ages of 8 to 10. The development of inner or covert speech however passes through several stages (Luria, 1982). While it evolves from external to whispered to inner speech, it simultaneously changes from expanded to fragmented to condensed speech.

An important point about the formation of inner (metacognitive) speech is that it develops out of the communication between the child and others who hold a parental-guiding role. This relates to Feuerstein's theory of Mediated Learning Experiences. It is the knowledgeable person (e.g., parent, teacher, or significant other) that guides the perceptual organization, thinking, and behavior of the developing child through intentioned verbal interaction during shared experiences so that adaptive (metacognitive) learning sets or habits become established in the child. It is this author's contention that there may be a deficit in the metacognitive skill repertoire of Native Indian children who come from reservation-type cultures. This deficit may not manifest within the demands of these cultures, but when compared to the demands of the highly verbal-analytic majority culture, it may be revealed by the responses of these children on the WISC-R.

Looking now at the results of the stepwise multiple regression, it was first found that the amount of parental overt and covert verbalization was significantly correlated with how the children performed on the WISC-R subtests measuring the Spatial ability. Two of the subtests comprising this recategorized score include Block Design and Object Assembly. Manipulation of the pieces involved in these tasks is sometimes accompanied by overt verbalizations. It is likely that the children who approached this task using systematic strategies controlled via metacognitive verbal-mediated processes did better than those who employed only simultaneous processing. It should be noted here that simultaneous processing rather than sequential processing is appropriate for this task according to the joint factor analysis of

Kaufman and McLean (1987). Furthermore, because the Native children have a strength in simultaneous processing, most did well on the WISC-R subtests measuring this. This does not mean however that those who employed better metacognitive strategies in addition to the simultaneous processing could not have done better. The frontal lobes have to be involved because no voluntary motor actions can occur without them, according to Luria's (1973) findings about brain mechanisms.

The stepwise procedure also found that the WISC-R Acquired Knowledge score was higher under the following conditions: (a) the more the child spoke English at home, (b) the more the parent spoke English at home, (c) the more the child used covert verbalization, and (d) the more the parent allowed the child to learn from his/her own mistakes. The first two conditions understandably relate to the childrens' performance on the WISC-R Vocabulary subtest, which measures the extent of a child's English word knowledge. The more bilingual a child's parents are, the fewer English words those parents will use at home. Even if a child learns more English words at school, he/she will likely restrict the range of vocabulary used to what is understood by the parents. The third condition directly relates to the use of metacognition (i.e., covert verbalization). Since the AK score was relatively low, it may also follow that most of these children did not use enough metacognition. The use of metacognition would be of most value to a child on the Arithmetic subtest, which requires concentration and mental computation. The fourth cultural variable that correlated with the WISC-R AK score was included to measure the Native Indian cultural value of non-interference. Allowing a child to learn from his/her own mistakes was at first considered an obstacle to Feuerstein's notion of Mediated Learning Experiences. The alternative on this scale was for the parent to say he/she tries to prevent the child from making mistakes. This was thought to reflect the parent's mediational efforts. The parental responses to this item however may have been interpreted differently. Perhaps preventing the child from making mistakes was interpreted as fostering dependence and helplessness by doing things for the child. Allowing the child to learn from his/her own mistakes could have been interpreted as fostering independence and responsibility which does not preclude mediated

Learning Experiences. At any rate, this single item did not function as it was intended.

Finally, the stepwise procedure found that the WISC-R Conceptual score was higher under the following conditions: (a) the more the child spoke English at home, (b) the more the parent spoke when socializing, (c) the more the child used covert verbalization, (d) the more the child perceived that mother expected him/her to be independent, and (e) the more observational rather than trial and error was the parent's style of learning. The WISC-R Conceptual score is measured by the Vocabulary, Similarities, and Comprehension subtests. The first of these subtests, Vocabulary, easily relates to the first two variables. Children who use more English at home and who happen to have parents who like to talk are more apt to acquire a larger vocabulary. Regarding the Similarities subtest, which measures verbal concept formation or abstract thinking ability (Sattler, 1982), it is understandable that a child's fluency with English would be imperative in being able to compare verbal definitions to sort out common elements. A child's use of covert verbalization may also be related to the Similarities subtest, since metacognitive processes are necessary for abstract thinking. Finally, the Comprehension subtest, which measures social judgment or common sense (Sattler, 1982), would likely require a good knowledge and fluency with English, which relates to the first two variables. Further, the more the children use covert verbalization, the better would be their metacognitive problem-solving strategies. In addition, the fourth variable (reflecting a child's perception of the level of independence expected by his/her mother) may relate to his/her knowledge of social conventions, because an independent child could only be independent to the degree that judgment and common sense were present. The last variable dealing with the parent's observational learning style is an unexpected finding. Instead, it was expected that the WISC-R Conceptual score might be improved by the parent's use of trial and error learning, which relates more to classroom practice (More, 1987). It may be however that a preference for observational learning goes hand-in-hand with good listening skills. More (1987) stated that traditional Native Indian culture also transfers its knowledge through legends told by elders. He called this the Listen-Then-Do style of learning (More, 1987, p.28). If these two styles were in fact highly correlated with one another, then the children of parents who were better observers/listeners may also be better in these skills which would make them more receptive to Mediated Learning Experiences. This is only speculation however and further research is needed to support this hypothesis.

In summary, the stepwise regression procedure provided some evidence, albeit tentative, that higher Sp, AK, and Cn recategorized WISC-R scores may have been associated with more English language usage at home, more Mediated Learning Experiences, and more covert (metacognitive) verbalization. Two questionnaire items did not correlate as expected, but this may have been due to the manner in which the parents interpreted them.

The present study focused on the Ojibwa children from a reservation school who had relatively poor Verbal IQs as measured on the WISC-R. Of additional interest were the cultural factors that were responsible for the higher Verbal IQs of several children who had relatively small V-P IQ differences (i.e., no more than 10 points). After the primary data collection and analysis was completed, the school principal was forwarded several questions about the students who scored more like children in the WISC-R standardization sample. He was directed to discuss the questions with the students' respective teachers. The questions were as follows:

1. Do these children read more often than others at home and/or school?
2. Do these children perform better in school than their same-age peers?
3. Do their parents have similar jobs, or are they working unlike other parents?
4. Has there been more stability in their families?
5. Are their parents involved in local politics?
6. Are there parents more involved in their education than other parents?
7. Did their parents have more education themselves compared to other parents?
8. Do their parents spend more time with them at home?

The data that was returned in handwritten form was compiled and put into a tabular form for easier analysis. This table may be seen in Appendix H.

The results of this supplementary analysis revealed the following. Those students with higher

Verbal IQs and smaller V-P IQ differences appear to read more than other students. In terms of academic achievement, they perform the same or better than others. They have employed parents whose work or interest involves the school (e.g., one was a teacher, one was the school janitor, one was the school bus driver, and one was the school secretary). They come from stable homes. They have more educated parents who spend more time with them at home and school. And finally, their parents generally seem more involved in their education. These findings suggest that in general, Ojibwa children with better verbal and academic skills have parents who are communicating the value of education to them. This may involve Mediated Learning Experiences as well as motivational processes. These findings are equivocal at best, based on subjective opinion, but they may be important variables to explore in future studies.

Educational Recommendations

Briefly, the results of this study suggest that Native Indian children living on reservations or in isolated communities have a strength in simultaneous processing, and a relative weakness in successive processing and metacognitive strategies. Therefore, three types of teaching recommendations can be made. The schools could (a) teach to their strength in simultaneous processing, (b) improve upon their relative weakness in successive or sequential processing, and/or (c) teach metacognitive strategies that can be applied to academic subject matter. Suggestions applicable to each recommendation are presented below.

More (1987) provided some suggestions of how one could teach to a child's strength in simultaneous processing. He indicated that a simultaneous processing style would favor a whole-word emphasis on learning to read. This would involve the use of a closure technique to teach the phonetic sounds of letters. The teacher would provide the child with written words having blank spaces where letters should go (e.g., only: _nly; on_y; onl_). The child would always be dealing with the whole while processing the word elements. Other suggestions were as follows: (1) provide 'advance organizers' with a deductive approach rather than an inductive approach, (2) use more visual aids while teaching (e.g., pictures, slides, overheads, posters, diagrams, videotapes, photographs, flow charts, etc.) (3) use a Whole Word method or Language

Experience method more than a Phonics approach to teaching reading, and (4) try the Keyword Method (Raugh & Atkinson, 1975) for building vocabulary.

Kaulback's (1984) recommendations were similar to those already discussed but two additional ones seem helpful: (1) try using computer-assisted instruction which capitalizes on visual presentation, and (2) consider ESL (English as a Second Language) or ESD (English as a Second Dialect) instruction to improve verbal comprehension.

Krywaniuk and Das (1976) experimented with a training program to improve the sequential processing of 40 Native children in grades 3 and 4 at Ermineskin School in Hobbema, Alberta. Half of the children (experimental group) were given 15 hours of remedial training whereas the other half (control group) received only three hours. The program encouraged verbalization to facilitate the use of memory and recall strategies. Training in sequential strategies used the following tasks: sequence story boards, parquetry, designs, serial recall, coding, matrix serialization, and filmstrips. The pretest and posttest instruments some of which measured simultaneous, successive, and speed factors, included:

the WISC, Raven's Progressive Matrices, the Figure Copying Test, memory for Designs test, a Serial Learning test, a Visual Short-term Memory test, the Stroop test, Cross-modal Coding test, and the Schonell Graded Readiness Vocabulary test. Results showed that the experimental group made significantly greater improvement on measures of serial and free recall than the control group. The authors claimed that visual and auditory short-term memory improved. Furthermore, the significant progress in task performance requiring successive processing was accompanied by a shift in the factor loadings of the tests. This means that the experimental group had begun to use sequential processing on those tasks requiring it. Based on the success of this training program, teachers may want to try using some of the tasks in their classrooms. Some of these are briefly described below.

The Sequence Story Boards consisted of three sets of 12 pictures. Each set could be arranged to tell a whole story. Children were given the picture sets in a random order and were asked to arrange them into three rows of four pictures each so that they followed a logical order. Children were encouraged to verbalize the rationale for their arrangement choices and were then instructed to tell the completed story.

In the Serial Recall task, two sets of 12 common objects were used. When the first set was shown, it was removed after a short time and the child was asked to recall as many objects as possible. As each one was recalled, it was placed in front of the child. This procedure was repeated until all the objects could be named. When the second set of objects was shown, the child was asked to group them according to some criterion before they were removed. They were then recalled in the procedure already described.

In the Coding task, hand and knee "claps" were symbolized as dots and squares respectively. The dots and squares were arranged in rhythmic patterns. Each pattern was shown visually and the child was instructed to "decode" the pattern through his/her actions. The series of patterns became increasingly more complex.

Several articles are reviewed here which provide suggestions to teachers for increasing the metacognitive skills of children.

Harth (1982) describes several methods by which a teacher can apply Feuerstein's Learning Potential Assessment Device approach to the classroom. The first method involves the regulation of behavior through inhibition and control of impulsivity. For children who show impulsivity during classroom discussions, the teacher should impose a latency in responding. One way is to have these students write out their answers before orally responding. When some control of impulsivity is observed, the teacher can fade out the procedure and replace it with cue words. For example, after asking a question, the teacher could say "stop", "think", and then "raise your hand." These words could then be transferred to a poster displayed in a conspicuous location.

A second strategy involves the improvement of deficient cognitive functions. One method of getting students to approach a task in a more organized manner is to use two sets of instructions on written assignments. The first set gives all the usual guidelines. The second set are composed of questions the student should ask while attempting to solve each part of the assignment. For example, in an assignment on learning to write titles a sample title is provided: mark Twain wrote the book tom sawyer. This is followed by cues: (1) Find the Title, (2) Will you underline it or put quotation marks around it? (3) what words will you capitalize? For children who lack planning behavior, the teacher should require them to verbalize their plan of attack before starting on a problem.

A third method involves enrichment of the task-related contentual repertoire. In other words, if efficient problem solving is to take place, then certain verbal concepts must be present. Three types of concepts must be taught: (1) orientation concepts (e.g., left-right, up-down, before-after, vertical-horizontal, dorsal-ventral, anterior-posterior, etc.); (2) concepts dealing with relationships between objects and events (e.g., identical, opposite, common, congruent, similar, different, equivalent, etc.); and (3) labels for specific objects or events and their characteristics (e.g., a rubber ball is round, can bounce, can be compressed, is spherical, etc.).

The final procedure involves creating reflective, insightful though processes. The goal is to make the children aware of their own problem-solving behaviors to promote generalization and transfer of skills. Several techniques are useful in creating insightful thought: (1) question reasons for responses, (2) discuss how a correct answer was attained, (3) compare a child's present performance with how he/she used to approach similar problems, (4) discuss systematic ways to approach a problem, (5) question and discuss sources of error, (6) have the child distinguish between correct and incorrect parts of answers, and (7) have the child generate similar examples to promote generalization.

Wong and Jones (1982) reported a metacognitive self-questioning technique that poor readers could benefit from. Their sample included 60 poor readers from grades 8 and 9 who became the experimental group, and 60 normal readers in grade 6 who served as a comparison group. The results indicated that the self-questioning technique helped the poor readers to become more aware of important textual elements and improved their ability to formulate questions on those elements. Furthermore, training facilitated their performances on subsequent comprehension tests. This technique did not however improve the metacomprehension or comprehension of the normal readers. The self-questioning technique which helped poor readers identify the main idea of paragraphs was composed of the following questions:

(a) What are you studying this passage for? (So you can answer some questions you will be given later); (b) Find the main idea/ideas in the paragraph and underline it/them; (c) Think of a question about the main idea you have underlined. Remember what a good question should be like. (Look at the prompt); (d) Learn the answer to your question; (e) Always look back at the questions and answers to see how each successive question and answer provide you with more information. (Wong & Jones, p.231)

Palinscar (1986) reported on a metacognitive procedure called reciprocal teaching that has been successful in improving the reading comprehension of poor readers at the junior high level. This teaching method involves a dialogue between the teacher and students which incorporates four main strategies:

1. Summarizing - Identifying and paraphrasing the main idea in the text.
2. Question Generating - Self-questioning about the type of information that is generally tapped on tests of comprehension and recall.
3. Clarifying - Discerning when there has been a breakdown in comprehension and taking the necessary action to restore meaning (e.g., reading ahead, rereading, asking for assistance).

4. <u>Predicting</u> - Hypothesizing what the structure and content of the text suggest will be presented next. (Palinscar, 1986, p.119)

These four points represent only the general strategies that the teacher and students use during the actual dialogue which occurs after the students have read a story or passage. The whole process includes much more. Initially, the teacher asks the students questions during the dialogue. After several days however, the teacher appoints students to act in the role of teacher by asking the other classmates the type of questions the teacher had asked. While the students learn this role, the real teacher provides prompts and encouragement when needed. This has been referred to as <u>scaffolded</u> instruction. Gradually the reciprocal teaching procedure is transferred to the students. Palinscar emphasized that this procedure should only be done using reading material at the instructional level and below. It was further recommended that daily comprehension tests should be graphed and the results shared with the student to reinforce progress. The following quotation exemplifies a typical reciprocal teaching session.

Each day, before beginning the dialogue, the group reviews the strategies they are learning, their importance, and the context in which the strategies are useful. Presented with the title of the text they will be reading, the group is encouraged to make use of the background information they have regarding the topic at hand, to make predictions about what they will learn in the text, and to indicate what they would like to learn regarding this topic. A teacher is then appointed for the first segment of text. The teacher and students read the segment (silently or orally, depending on the decoding skills of the students) and then the "teacher" (student or adult) asks a question to which the others respond. This teacher then summarizes and invites elaborations on the summary from others in the group. This leads to a discussion of any clarifications that the members of the group made while working with the text or feel still need to be made. Finally, the group discusses their predictions regarding upcoming text and a new teacher is appointed. (Palinscar, 1986, p.119)

The suggestions above on the use of metacognitive strategies in the classroom should be qualified by adding that these procedures work best with students who are not doing as well academically. Employing metacognitive strategies with students who are already successful learners may have either no benefit or result in worse academic performance (Schunk, 1986).

Future Research

There are several limitations to the present study. First, the subjects were not randomly sampled from the entire school population between the ages of 7 and 12. Instead, teachers were asked to provide the principal with a list of children from their classrooms who represented those of average achievement. Therefore, any exceptionally bright or slow children were excluded. Random sampling was only done on the list of "average" students. Therefore, the results are technically limited to this group. Second, the sample size was minimally large for the number of variables explored on the stepwise multiple regression. Third, the questionnaires developed for this study were inadequately field-tested. Finally, the cross-validation of the WISC-R Sequential scores with the K-ABC Sequential scores provided less than moderate support for the argument that the WISC-R Sequential scores were actually measuring sequential processing.

Future research in this area should focus on a large random sample (e.g., N = 100) of Sioux Native Indian children stratified by grade levels 4 to 8. An impressive instrument that measures cultural values has been normed on this type of group (Plas & Bellet, 1983). Finally, factor analysis of the WISC-R would be an improvement over simply trying to cross validate it with the K-ABC.

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Appendix A

(Native Child Interview Questionnaire)

NATIVE CHILD INTERVIEW QUESTIONNAIRE

SUBJECT'S NAME____________________CODE_______

DATE____________TIME______

1. Do you let other people show you how before trying something new?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

2. Does your mother (or other parent) think you should do things on your own?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

3. Do you speak English at home?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

4. Do you speak Obibwa (or other Native language) at home?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

5. When you do good work in school, do you tell your mother (or other parent) about it?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

6. When you do good work in school, do you tell your friends about it?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

7. When you know the answer to a question that your friends don't know, do you give your teacher the answer?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

8. Is it okay to be quiet when you're with your friends?

______	______	______	______	______
Never	Almost Never	Sometimes	Almost Always	Always

9. When remembering a story do you think in words? i.e., in your head, do you tell yourself what happened in the story?

____	____	____	____	____
Never	Almost Never	Sometimes	Almost Always	Always

10. When remembering a story do you think in pictures? i.e., can you see the people/places from the story in your head?

____	____	____	____	____
Never	Almost Never	Sometimes	Almost Always	Always

Appendix B

(Native Adult Rating Form)

NATIVE ADULT RATING FORM

SUBJECT'S NAME______________CODE_______

DATE______________TIME_________

INSTRUCTIONS: Please respond to the scales below by placing an (X) on one of the lines as if to weight the scale in favor of one or the other description so that it reflects who you are. An (X) over a 4 would indicate an equal balance between the two characteristics. The closer the (X) is to one or the other description, the more that description represents you.

1. Thinking about my experiences:

I talk to myself about them in my mind	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	I visualize pictures of them in my mind

2. When learning new things:

I try them firsthand using trial and error	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	I watch others do them before trying

3. The language(s) I speak at home is(are):

English	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	Ojibwa or Other Native language

4. My style of childrearing is to:

Prevent my child from making mistakes	1	2	3	4	5	6	7	Let my child learn from his/her own mistakes

5. When socializing with others:

I feel uneasy unless I am talking	1	2	3	4	5	6	7	I feel comfortable being silent

Appendix C

(Parental Letter of Consent)

Date:

Faculty of Education
Box 116
The University of Manitoba
Winnipeg, Manitoba
R3T 2N2

Dear Mr. and/or Mrs.

I am a graduate student in the Department of Educational Psychology at the University of Manitoba. I am interested in the learning styles of various cultural groups in Canada. At this point, I would like to study the learning style of Native Indian children.

I believe the information that I will be gathering from my research project will also have benefit to your child's future learning experience in the school.

If you agree with your child's participation in my study, he or she will be asked to do the following:
(1) Draw a picture of a man.
(2) Tasks such as repeating numbers, pointing to pictures, recalling facts, arranging pictures into stories, copying designs with blocks, putting puzzles together, and so on.
(3) Provide information such as to what extent he or she speaks English at home, tells others about good work in school, thinks in pictures or words when recalling a story, and so on.

You would also be asked to provide some information about language spoken at home, and so on. This would take only about 5 minutes of your time at the school.

Your answers and the results of your child's assessment will be kept private and confidential. Any feedback given to teachers or to you about the results will represent the group average, not any one person. No one will be identified. Should you or your child wish to withdraw from this study, this can be done at any time without penalty.

Thank you for taking the time to read this letter and for showing an interest in your child's education. If you would like any further information about this study, you may contact your local school board.

Sincerely,

Ronald Teffaine

Ron Teffaine
School Psychology Graduate Student

I hereby agree to the inclusion of my child in this research project:

____
(Signature)

Appendix D

(Sample Data)

OBS	SUB	AGE	SEX	DIFF	SP	SE	CN	AK	KABC	C1	C2	C3	C9	C10	A1	A2	A3	A4	A5	VIQ	PIQ	FSIQ	K_A	W_A
1	1	8.50	F	37	33	17	12	15	26	5	1	3	2	5	4	5	3	4	4	67	104	83	15	9
2	2	8.10	F	40	49	29	24	26	23	5	1	5	3	5	2	6	1	1	2	92	132	112	15	16
3	3	8.70	F	25	26	26	10	16	25	3	4	1	3	5	4	4	4	4	5	66	91	76	15	14
4	4	7.90	F	24	36	30	24	23	35	5	1	5	5	1	3	1	4	2	1	87	111	99	26	18
5	5	8.40	M	15	29	20	13	21	17	3	1	5	1	3	6	5	2	5	2	73	88	79	12	14
6	6	9.70	M	6	33	26	25	27	22	5	3	3	5	3	6	7	4	7	4	95	101	97	15	16
7	7	7.11	F	6	34	34	18	26	36	3	3	5	3	3	4	3	4	7	4	90	96	92	27	25
8	8	8.80	M	16	29	23	19	23	22	2	1	4	4	3	7	3	1	5	1	84	100	90	12	12
9	9	8.50	M	29	44	34	29	29	28	3	1	5	5	5	5	2	4	4	5	101	130	116	17	19
10	10	9.90	M	14	33	15	19	17	18	5	1	5	2	3	4	5	4	4	3	79	93	85	14	11
11	11	8.10	F	28	28	23	10	20	15	3	3	4	3	1	5	4	4	3	7	70	98	82	10	14
12	12	8.10	F	22	33	21	14	22	23	2	1	5	1	5	4	3	4	4	3	74	96	84	16	13
13	13	9.00	M	29	31	25	16	18	19	4	3	4	4	4	2	6	3	2	3	75	104	87	13	14
14	14	8.00	M	2	33	25	29	28	27	3	5	4	3	3	4	6	1	4	5	98	100	99	16	19
15	15	8.40	M	11	36	20	15	22	23	5	1	3	5	5	4	4	4	3	4	84	95	88	14	14
16	16	9.40	F	23	39	32	21	32	36	3	3	4	3	2	4	4	3	4	6	94	117	104	25	23
17	17	12.80	M	10	23	16	19	17	15	5	2	5	4	2	5	4	4	3	7	75	85	78	8	11
18	18	8.11	F	13	29	26	18	26	33	1	3	5	1	5	4	6	1	4	5	82	95	87	22	18
19	19	9.40	F	16	28	24	15	23	31	3	4	3	3	4	5	7	1	6	7	75	91	81	20	18
20	20	9.11	M	1	36	24	36	32	28	5	4	5	3	3	4	5	4	4	3	105	102	103	18	18
21	21	12.00	M	26	37	17	23	18	24	3	1	5	3	3	5	7	4	4	7	79	105	90	15	12
22	22	10.60	F	23	33	17	23	17	18	4	5	4	2	5	4	3	1	4	5	78	101	87	12	10
23	23	10.10	F	32	45	33	21	28	30	4	3	4	3	3	6	7	4	7	4	91	123	105	20	22
24	24	9.11	M	4	35	27	27	30	26	4	2	5	2	5	2	1	1	2	2	100	104	101	16	21
25	25	11.50	M	6	28	18	21	21	26	3	4	4	4	4	7	4	4	4	3	80	86	81	15	13
26	26	10.10	F	25	36	22	21	19	20	3	5	4	2	5	4	4	4	4	5	80	105	91	12	15
27	27	11.70	F	23	40	24	21	22	21	5	3	5	3	5	3	2	1	4	6	85	108	95	9	16
28	28	11.40	F	42	42	34	19	15	29	3	4	3	2	2	4	3	4	3	3	75	117	93	18	17
29	29	11.30	M	36	43	28	25	23	33	3	2	5	3	5	5	3	4	5	3	88	124	105	23	16
30	30	12.11	M	26	30	25	16	17	34	4	4	2	4	5	7	1	4	5	3	74	100	85	22	15
31	31	11.11	F	12	32	27	26	25	26	1	1	5	3	5	6	7	4	7	4	90	102	95	21	15
32	32	12.90	F	22	32	21	16	18	32	3	5	5	3	5	5	4	4	5	4	74	96	84	22	16
33	33	12.80	M	12	36	19	20	26	34	5	5	5	2	5	2	1	1	5	4	90	102	95	25	14
34	34	12.10	M	26	34	18	18	16	27	3	3	4	2	4	3	3	4	4	4	74	100	85	17	10
35	35	11.70	M	31	36	24	19	21	23	3	3	4	2	3	3	3	4	4	4	81	112	95	16	15
36	36	11.11	F	9	33	23	31	31	24	3	5	3	3	3	6	6	5	6	5	102	93	98	20	18
37	37	11.60	F	33	29	28	10	17	25	4	4	4	3	4	3	1	4	4	7	67	100	81	18	14
38	38	12.10	M	44	38	21	18	17	23	4	3	3	5	4	4	5	4	3	3	73	117	92	14	8
39	39	12.70	M	17	32	26	21	25	25	5	3	4	4	4	5	3	4	5	3	85	102	92	16	17
40	40	12.20	F	44	36	27	17	15	26	3	3	4	1	5	4	3	4	3	3	70	114	89	17	14

Appendix E

Subject	WISC-R Recategorized Scores Sp	Se	AK	Cn	Sp>Se	Sp> Se>AK	Sp> Se>Cn	Sp>Se> AK>Cn
1	33	17	15	12	Yes	Yes	Yes	Yes
2	49	29	26	24	Yes	Yes	Yes	Yes
3	26	26	16	10				
4	36	30	23	24	Yes	Yes	Yes	
5	29	20	21	13	Yes		Yes	
6	33	26	27	25	Yes		Yes	
7	34	34	26	18				
8	29	23	23	19	Yes		Yes	
9	44	34	29	29	Yes	Yes	Yes	
10	33	15	17	19	Yes			
11	28	23	20	10	Yes	Yes	Yes	Yes
12	33	21	22	14	Yes		Yes	
13	31	25	18	16	Yes	Yes	Yes	Yes
14	33	25	28	29	Yes			
15	36	20	22	15	Yes		Yes	
16	39	32	32	21	Yes		Yes	
17	23	16	17	19	Yes			
18	29	26	26	18	Yes		Yes	
19	28	24	23	15	Yes	Yes	Yes	Yes
20	36	24	32	36	Yes			
21	33	17	17	23	Yes			
22	45	33	28	21	Yes	Yes	Yes	Yes
23	35	27	30	27	Yes			
24	28	18	21	21	Yes			
25	36	22	19	21	Yes	Yes	Yes	
26	40	24	22	21	Yes	Yes	Yes	Yes
27	42	34	15	19	Yes	Yes	Yes	
28	43	28	23	25	Yes	Yes	Yes	
29	30	25	17	16	Yes	Yes	Yes	Yes
30	32	27	25	26	Yes	Yes	Yes	
31	32	21	18	16	Yes	Yes	Yes	Yes
32	36	19	26	20	Yes			
33	34	18	16	18	Yes	Yes		
34	36	24	21	19	Yes	Yes	Yes	Yes
35	33	23	31	31	Yes			
36	33	23	31	31	Yes			
37	29	28	17	10	Yes	Yes	Yes	Yes
38	38	21	17	18	Yes	Yes	Yes	
39	32	26	25	21	Yes	Yes	Yes	Yes
40	36	27	15	17	Yes	Yes	Yes	

Total No. of subjects:	$\frac{38}{40}$ =	$\frac{21}{40}$ =	$\frac{27}{40}$ =	$\frac{12}{40}$ =
Percentage of subjects who displayed the patterns:	95%	53%	68%	30%

Appendix F

(Correlation Matrix)

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER H0:RHO=0 / N = 40

	SP	SE	AK	CN	C1	C2	C3	C9	C10	A1	A2
SP WISC-R SPATIAL	1.00000 0.0000	0.47436 0.0020	0.30477 0.0559	0.43010 0.0056	0.18771 0.2461	-0.17751 0.2732	0.23991 0.1359	0.03825 0.8147	0.11891 0.4649	-0.29545 0.0642	-0.02112 0.8971
SE WISC-R SEQUENTIAL	0.47436 0.0020	1.00000 0.0000	0.44185 0.0043	0.20549 0.2034	-0.17600 0.2773	0.00477 0.9767	-0.01094 0.9466	0.16626 0.3052	-0.13007 0.4237	-0.06684 0.6819	-0.12179 0.4541
AK WISC-R ACQUIRED KNOWLEDGE	0.30477 0.0559	0.44185 0.0043	1.00000 0.0000	0.67215 0.0001	-0.03324 0.8387	-0.00143 0.9930	0.30527 0.0554	0.15472 0.3404	-0.11828 0.4673	0.04330 0.7908	0.15529 0.3386
CN WISC-R CONCEPTUAL	0.43010 0.0056	0.20549 0.2034	0.67215 0.0001	1.00000 0.0000	0.09034 0.5793	0.06253 0.7015	0.34455 0.0295	0.20136 0.2128	-0.07010 0.6673	0.04051 0.8040	0.14398 0.3754
C1 OBSERVATIONAL LEARNING	0.18771 0.2461	-0.17600 0.2773	-0.03324 0.8387	0.09034 0.5793	1.00000 0.0000	-0.02554 0.8757	-0.04498 0.7829	0.35614 0.0241	-0.08712 0.5930	-0.32686 0.0395	-0.18286 0.2587
C2 LEVEL OF INDEPENDENCE	-0.17751 0.2732	0.00477 0.9767	-0.00143 0.9930	0.06253 0.7015	-0.02554 0.8757	1.00000 0.0000	-0.34462 0.0294	-0.11405 0.4835	0.06179 0.7048	-0.02566 0.8751	-0.06765 0.6783
C3 AMOUNT OF ENGLISH SPOKEN	0.23991 0.1359	-0.01094 0.9466	0.30527 0.0554	0.34455 0.0295	-0.04498 0.7829	-0.34462 0.0294	1.00000 0.0000	-0.22933 0.1546	-0.04937 0.7623	-0.23105 0.1514	-0.08807 0.5889
C9 VERBAL STYLE	0.03825 0.8147	0.16626 0.3052	0.15472 0.3404	0.20136 0.2128	0.35614 0.0241	-0.11405 0.4835	-0.22933 0.1546	1.00000 0.0000	-0.20667 0.2007	0.25497 0.1123	0.01245 0.9392
C10 VISUAL STYLE	0.11891 0.4649	-0.13007 0.4237	-0.11828 0.4673	-0.07010 0.6673	-0.08712 0.5930	0.06179 0.7048	-0.04937 0.7623	-0.20667 0.2007	1.00000 0.0000	-0.15538 0.3384	-0.12452 0.4440
A1 THINKING STYLE	-0.29545 0.0642	-0.06684 0.6819	0.04330 0.7908	0.04051 0.8040	-0.32686 0.0395	-0.02566 0.8751	-0.23105 0.1514	0.25497 0.1123	-0.15538 0.3384	1.00000 0.0000	0.28436 0.0753
A2 LEARNING STYLE	-0.02112 0.8971	-0.12179 0.4541	0.15529 0.3386	0.14398 0.3754	-0.18286 0.2587	-0.06765 0.6783	-0.08807 0.5889	0.01245 0.9392	-0.12452 0.4440	0.28436 0.0753	1.00000 0.0000
A3 LANGUAGE PREFERENCE	-0.01111 0.9458	0.06925 0.6711	-0.21045 0.1924	-0.04384 0.7882	-0.00314 0.9847	-0.03744 0.8186	-0.20827 0.1972	0.26455 0.0990	-0.24052 0.1349	0.29205 0.0675	0.00834 0.9593
A4 CHILDREARING STYLE	-0.14496 0.3721	0.10729 0.5099	0.27437 0.0867	0.08924 0.5840	-0.27476 0.0862	0.19805 0.2206	-0.09485 0.5605	0.00320 0.9843	0.01817 0.9114	0.59971 0.0001	0.28573 0.0739
A5 LEVEL OF TALK WHEN SOCIALIZING	-0.23202 0.1497	-0.11964 0.4621	-0.06678 0.6822	-0.17339 0.2846	-0.09692 0.5519	0.31141 0.0505	-0.10529 0.5179	-0.02686 0.8693	-0.08635 0.5963	0.01122 0.9452	0.19804 0.2206

	A3	A4	A5
SP WISC-R SPATIAL	-0.01111 0.9458	-0.14496 0.3721	-0.23202 0.1497
SE WISC-R SEQUENTIAL	0.06925 0.6711	0.10729 0.5099	-0.11964 0.4621
AK WISC-R ACQUIRED KNOWLEDGE	-0.21045 0.1924	0.27437 0.0867	-0.06678 0.6822

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER H0:RHO=0 / N = 40

	A3	A4	A5
CN WISC-R CONCEPTUAL	-0.04384 0.7882	0.08924 0.5840	-0.17339 0.2846
C1 OBSERVATIONAL LEARNING	-0.00314 0.9847	-0.27476 0.0862	-0.09692 0.5519
C2 LEVEL OF INDEPENDENCE	-0.03744 0.8186	0.19805 0.2206	0.31141 0.0505
C3 AMOUNT OF ENGLISH SPOKEN	-0.20827 0.1972	-0.09485 0.5605	-0.10529 0.5179
C9 VERBAL STYLE	0.26455 0.0990	0.00320 0.9843	-0.02686 0.8693
C10 VISUAL STYLE	-0.24052 0.1349	0.01817 0.9114	-0.08635 0.5963
A1 THINKING STYLE	0.29205 0.0675	0.59971 0.0001	0.01122 0.9452
A2 LEARNING STYLE	0.00834 0.9593	0.28573 0.0739	0.19804 0.2206
A3 LANGUAGE PREFERENCE	1.00000 0.0000	0.15896 0.3272	0.04109 0.8012
A4 CHILDREARING STYLE	0.15896 0.3272	1.00000 0.0000	0.16411 0.3116
A5 LEVEL OF TALK WHEN SOCIALIZING	0.04109 0.8012	0.16411 0.3116	1.00000 0.0000

Appendix G

Multicollinearity Assessment

Using VIF Values

DEP VARIABLE: SP WISC-R SPATIAL

ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	2	159.28127	79.64063468	3.002	0.0619
ERROR	37	981.69373	26.53226299		
C TOTAL	39	1140.97500			

ROOT MSE	5.150948	R-SQUARE	0.1396
DEP MEAN	34.225	ADJ R-SQ	0.0931
C.V.	15.05025		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|	VARIANCE INFLATION	VARIABLE LABEL
INTERCEP	1	42.46496469	3.46023941	12.272	0.0001	0	INTERCEPT
A1	1	-1.17326080	0.61091347	-1.921	0.0625	1.00012597	THINKING STYLE
A5	1	-0.76963932	0.51314263	-1.500	0.1421	1.00012597	LEVEL OF TALK WHEN SOCIALIZING

$$VIF = \frac{1}{(1-R^2)} = \frac{1}{0.8604} = 1.16$$

Since each variable has a VIF value < 1.16, there is no multicollinearity here.

DEP VARIABLE: CN WISC-R CONCEPTUAL

ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	5	498.07009	99.61401799	4.187	0.0045
ERROR	34	808.90491	23.79132088		
C TOTAL	39	1306.97500			

ROOT MSE	4.877635	R-SQUARE	0.3811
DEP MEAN	19.975	ADJ R-SQ	0.2901
C.V.	24.4187		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|	VARIANCE INFLATION	VARIABLE LABEL
INTERCEP	1	-3.43989597	6.31045920	-0.545	0.5892	0	INTERCEPT
C3	1	3.36830709	0.90703981	3.714	0.0007	1.25787401	AMOUNT OF ENGLISH SPOKEN
C5	1	1.85008233	0.71855571	2.575	0.0146	1.10626600	VERBAL STYLE
C2	1	1.66703403	0:64261297	2.594	0.0139	1.33824242	LEVEL OF INDEPENDENCE
A5	1	-1.02452828	0.52587039	-1.948	0.0597	1.17136350	LEVEL OF TALK WHEN SOCIALIZING
A2	1	0.85479256	0.43933211	1.946	0.0600	1.07879107	LEARNING STYLE

$$VIF = \frac{1}{(1-R^2)} = \frac{1}{0.6189} = 1.62$$

Since none of these variables exceeds the VIF of 1.62, there is no multicollinearity here.

DEP VARIABLE: AK WISC-R ACQUIRED KNOWLEDGE

ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	4	311.59143	77.89785795	3.906	0.0100
ERROR	35	698.00857	19.94310195		
C TOTAL	39	1009.60000			

ROOT MSE	4.46577	R-SQUARE	0.3086
DEP MEAN	22.1	ADJ R-SQ	0.2296
C.V.	20.2071		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|	VARIANCE INFLATION	VARIABLE LABEL
INTERCEP	1	8.52890495	5.04477482	1.691	0.0998	0	INTERCEPT
C3	1	1.85325114	0.77235347	2.399	0.0219	1.08803407	AMOUNT OF ENGLISH SPOKEN
A4	1	1.27344328	0.51930521	2.452	0.0193	1.03310868	CHILDREARING STYLE
C5	1	1.36521207	0.66090250	2.066	0.0463	1.11645010	VERBAL STYLE
A3	1	-1.08016546	0.58849951	-1.835	0.0749	1.12835506	LANGUAGE PREFERENCE

$$VIF = \frac{1}{(1-R^2)} = \frac{1}{0.6914} = 1.45$$

Since none of the variables have VIF values that exceed 1.45, there is no multicollinearity here.

Appendix H

Appendix H

SUBJECT No.	Reads more than others at home &/or school	Performs better in school than same-age peers	Parents are employed	Parents work involves the school &/or students	Family life & composition is stable	Parent(s) are(is) involved in local politics	Parents are more involved in their child's education than other parents.	Parents have more education themselves compared to other parents	Parents spend more time with them at home	Verbal IQ from WISC-R	Verbal - Performance IQ difference
Subject 6	✓	(lower) X	✓	✓	✓	X	✓	?	?	95	6
Subject 7	✓	✓	✓	✓	?	✓	?	✓	✓	90	6
Subject 14	✓	(same) X	✓	✓	?	X	✓	✓	✓	98	2
Subject 20	✓	✓	✓	X	✓	X	✓	✓	✓	105	1
Subject 24	(same) X	✓	✓	✓	✓	X	✓	?	✓	100	4
Subject 25	(same) X	(same) X	✓	X	✓	✓	✓	?	(same) X	85	6
Subject 36	✓	✓	✓	✓	✓	✓	✓	✓	✓	102	9
15	(less) X	(same) X	?	?	?	?	?	?	?	84	11
17	X	X	✓	✓	✓	X	X	X	X	75	10
Total	5/7	4/7	7/7	5/7	5/5	3/7	6/6	4/4	5/6	N = 7	N = 7
Percent	71	57	100	71	100	43	100	100	83	$\bar{X}$ = 96	$\bar{X}$ = 5