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Cognitive and Reading Profiles of Two Samples of Canadian First Nations Children: Comparing Two Models for Identifying Reading Disability

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Abstract

Two Canadian First Nations samples of Grades 3 and 4 children were assessed for cognitive processing, word reading, and phonological awareness skills. Both groups were from Plains Cree rural reservations in different provinces. The two groups showed significant differences on several key cognitive variables although there were more similarities than differences. Groups, separately and combined, showed a significant relationship between decoding, phonological awareness variables, word decoding, and successive processing that has also been observed among children from the mainstream culture. In general, the cognitive processing, reading, and reading subskills of First Nations children are, on average, below the norms for these measures. The findings are discussed in terms of reading disability identification practices from a Discrepancy Model and the Consistency–Discrepancy Model using PASS (Planning, Attention, Simultaneous, and Successive) theory among First Nations children.

Résumé

Deux échantillons d'enfants des Premières nations canadiennes dans la troisième et quatrième année scolaire ont été évalués pour le traitement cognitif, la lecture des mots et les compétences de sensibilisation phonologique. Les deux groupes venaient des réserves rurales des Cris des plaines dans de différentes provinces. Les deux groupes ont démontré des différences significatives par rapport à plusieurs variables cognitives clés bien qu'il y avait plus de similitudes que de différences. Les groupes, séparément et

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combinés, ont démontré une relation significative entre le décodage, les variables de sensibilisation phonologique, le décodage de mots et le traitement successive, ce qui a également été observée chez les enfants de la culture dominante. En général, le traitement cognitif, la lecture et les sous-compétences en lecture des enfants des Premières Nations sont, en moyenne, en dessous des normes pour ces mesures. Les résultats sont discutés en termes de méthodes d'identification des troubles de l'apprentissage de la lecture à la fois par rapport à un Modèle de Discordance et le Modèle Contradiction-Cohérence en utilisant la théorie simultanée et successive de la planification et l'éveil d'attention, ou théorie « PASS », parmi les enfants des Premières nations.

Keywords
First Nations, cognitive, reading, reading disability identification

Introduction

There has been limited research on the cognitive and learning profiles of Canadian First Nations children and youth. Knowing the cognitive and achievement profiles of Canadian First Nations children could aid in the understanding of possible reasons for success or failure in various areas of achievement, and aid in how we identify those with specific learning disabilities. It has been well documented that First Nations children are at risk for achievement delays and school failure/dropout. While published drop-out rates are hard to find, an estimate from 1992 to 1998 is a drop-out rate of 88% of First Nations children living on reserves in Canada (Mendelson, 2008). Also, well documented is an alarmingly high rate of reading delays within this population (Das, Janzen, & Georgiou, 2007; T. Janzen, 2000) although the reasons for less-well-developed reading skills are not well understood.

First Nations groups in Canada comprise over a million people representing more than 52 nations (such as Cree, Blackfoot, and Dene, etc.) and more than 60 languages (http://www12.statcan.gc.ca/census-recensement/2006/as-sa/97-558/index-eng.cfm). The single-largest language group among First Nations in Alberta and Saskatchewan is the Cree group (Statistics Canada, 2008a). A majority of First Nations peoples, estimated at 62% (not including Inuit and Metis) live on reserves (Assembly of First Nations, http://www.afn.ca/article.asp?id=764#_ednref14). While diversity or heterogeneity of First Nations groups has been presumed (Irvine & Berry, 1988), there is little comparative cognitive or achievement data from one First Nations group to another. Conceivably, one might expect that specific cultural and contextual influences could result in differences between First Nations groups as much as between First Nations and non–First Nations groups.

Cognitive Ability Among Canadian First Nations

The interpretation of standardized cognitive test results with First Nations populations has several major problems. First, standardized cognitive tests have been critiqued in terms of a lack of culture fairness for those of diverse cultural or linguistic backgrounds (Ortiz, Ochoa, & Dynda, 2012). While it has generally been recognized that no test can be completely culture-free or unbiased, standardized tests remain dominant in terms of their use for critical decision making and intervention planning in schools (Butcher, Nezami, & Exner, 1998). At the same time, it is an erroneous assumption that all First Nations people will perform the same on standardized tests any more than this would hold for other diverse groups (Common & Frost, 1988). This is true even when First Nations individuals have been included in the test standardization sample, as the unique patterns or profile of individual First Nations groups are simply lost in the larger data set (Lewis, 1998). One possible solution suggested for this is the development of local norms for each particular First Nations group (Lewis, 1998). H. L. Janzen, Skakum, and Lightning (1994) argued that standardized tests have little value unless normed and interpreted based on the local First Nations community. This is pragmatically quite difficult given the paucity of research and lack of normative data for First Nations populations, the heterogeneity of First Nations groups, and the fundamental issue of having multiple test norms even in a cultural mosaic such as Canada. Added to this difficulty is a lack of any systematic collection of standardized cognitive or achievement data with Canadian First Nations with some exceptions (e.g., British Columbia; Richards, Vining, & Weimer, 2010). Thus, it remains necessary to understand how various First Nations groups perform on cognitive tests so that one might properly interpret them, and of course, use the results in a fair and ethical way in the identification and intervention planning for those with specific learning disabilities.

Several studies have attempted to describe the characteristic cognitive patterns of performance among First Nations populations (Hilberg & Tharp, 2002; Kleinfeld & Nelson, 1991). Several studies have focused on the fact that First Nations groups tend to underperform on Wechsler Scales of Intelligence and that this is mainly realized in terms of relatively higher performance intelligence compared with verbal intelligence (Dolan, 1999; Suzuki & Valencia, 1997). In fact, within a First Nations sample, one study reported that performance on spatial tasks was an average of 10 standard score points higher than their verbal, sequencing or acquired knowledge. Rougas (2000) reported that the Mohawk children were significantly higher in visual processing than were Caucasian children. Several researchers have confirmed that among First Nations learners, simultaneous visual or spatial ability is normatively average or better while successive or sequential processing is frequently observed to be a normative and relative personal weakness (Davidson, 1992; Hilberg & Tharp, 2002; T. Janzen, 2000; Krywaniuk & Das, 1976). McCullough, Walker, and Diessner (1985) suggested that the pattern of higher spatial/simultaneous ability compared with sequential/successive ability is so frequently observed that it may be indicative of a First Nations cognitive style. However, the above authors did not distinguish between style and ability or between style and processes. Also, there is no consistent and robust finding of a characteristic First Nations cognitive style (More, 1989). We may not be surprised at an inability to find a unique cognitive or learning style for all First Nations children given the considerable heterogeneity that is expected to be observed within and between First Nations groups in North America (Irvine & Berry, 1988). However, few studies have examined

First Nations groups for intergroup differences and similarities in cognitive and achievement ability or how this might relate to the identification of reading disability.

Spatial and sequential cognitive abilities have been operationalized as simultaneous and successive processing, respectively, in measures such as the Kaufman Assessment Battery 2nd Edition (Kaufman & Kaufman, 2004) as well as the Cognitive Assessment System (CAS; Naglieri & Das, 1997). The CAS is based on the PASS (Planning, Attention, Simultaneous, and Successive) cognitive processing theory, where cognition is organized in three systems (see Das, Naglieri, & Kirby, 1994). The first is the Planning system, which is the executive control system responsible for controlling and organizing behavior, selecting or constructing strategies, and monitoring performance. The second is the Attention system, which is responsible for maintaining arousal levels and alertness and for ensuring focus on appropriate stimuli. The final system is the information-processing system, which uses Simultaneous and Successive processing to encode, transform, and retain information. In Simultaneous processing, the relationship between items and their integration into whole units of information is what is coded. In Successive processing, information is coded so that the links between items are sequential in nature.

Achievement Profiles of First Nations Children

An unfortunate reality for many Canadian First Nations children is low achievement relative to their non–First Nations counterparts, including low high school completion rates (Gilliland, 1995; T. Janzen, 2000; Larose, 1991, Mendelson, 2008; Richards et al., 2010). One concern driving the present study is the frequency of low reading achievement among Canadian First Nations children (Lewis, 1998; McCullough et al., 1985; McShane & Plas, 1988; Richards et al., 2010). A previous study, arising from the same population of First Nations children as one our samples, found that the First Nations sample was significantly underachieving in reading as reflected in auditory discrimination, auditory vocabulary, phonetic analysis, and reading comprehension (T. Janzen, 2000). Functionally, this represented an average of a two grade-level deficit in all reading measures compared with a national standardization sample (T. Janzen, 2000). Thus, it is important to understand not only the status of achievement for First Nations samples, but also the cognitive sequelae of reading underachievement to aide in the identification of reading disability among this population.

Low achievement among First Nations and other groups of children can be related to many variables including such things as attendance, stability of enrollment, socioeconomic status (SES), single parent homes, and negative parental attitudes to school (Boloz & Varrati, 1983; Lewis, 1998; Weiss, Saklofske, Prifitera, & Holdnack, 2006). In the case of reading, many of these same contextual factors have been explored as well as factors like home literacy, attitudes to reading, exposure to print, linguistic factors, and so on (Calfee & Curley, 1995). However, it is beyond the purview of this study to examine these contextual factors. Rather, the focus of the present study is in understanding the relationship of the more proximal and distal cognitive abilities that relate to reading and to the identification of those with a specific reading disability.

Relationship of Cognitive Ability to Reading

The cognitive processes that are more proximal to reading are those linguistic skills that are directly related to reading. The most frequently recognized proximal processes in word reading are phonological awareness and Rapid Automatized Naming (RAN; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Share & Stanovich, 1995; Wolf & Bowers, 1999). The distal cognitive processes are more general and modality unspecific underlying cognitive processes and are expected to enable the development of proximal processes.

Several studies with non–First Nations children using the PASS model have shown that Simultaneous processing is more strongly related to reading comprehension while Successive processing is more strongly related to word decoding (e.g., Das, Nanda, & Dash, 1996; Kirby, Booth, & Das, 1996). Furthermore, it has generally been found that one of the primary characteristics of children with word decoding problems is poor Successive processing (Das et al., 1994; Das, Parrila, & Papadopoulos, 2000).

Our previous study with First Nations children showed that the reading disabled group shows the same pattern of cognitive deficits, namely, poor successive processing, compared with other research studies with non–First Nations children (Das et al., 2007). That is, First Nations children who are failing to read tend to be more similar than different when compared with children from non–First Nations cultures that are also failing to read. However, we must still consider the variance created by environmental factors to determine if this finding holds true across more than one group of First Nations children in Canada. Should we continue to find that multiple First Nations groups have a similar pattern of relationship between reading and cognition, this might aide in the identification of learning disabilities.

Why would we expect more universal explanations for failure to read among First Nations populations in Canada? One possible answer is that there is some homogeneity or surface similarity among Canadian First Nations groups and within the groups selected for this study in particular. In our study, both groups (Alberta and Saskatchewan First Nations groups) are considered Plains Indian groups (McShane & Berry, 2011) and both were located on a rural reserve near a major urban center. Both groups have been educated using English language for the past 45+ years. One might expect there to be more similarity than differences between these two rural reservation groups in terms of culture, social, and economic conditions; language history; and even education. Another similarity is that, for both groups, a majority of the current population are below 20 years of age and it is estimated that approximately only 30% retain any knowledge of their Aboriginal language (Pittman, 2009). For both groups, unemployment is very high in the community and the median income for those above 15 is below poverty levels in Canada (Statistics Canada, 2008b). However, several important differences also exist culturally, and in terms of education, that might lead to differences. In the present case, the Alberta group has access to considerable resources in the form of oil royalties and they are the fourth largest band in Canada, with more than 16,000 members. Despite the presence of resources, there are still the same socioeconomic hardships faced by this group as would be seen in Saskatchewan. Educationally, the Alberta group generally follows the Alberta curriculum, but is able to modify this to meet their particular local needs. The same holds true for the Saskatchewan group which follows the provincial curriculum. The Saskatchewan group has relatively less access to natural resources and was considerably smaller in terms of population with only a little more than 1,000 people reported living on the reserve in 2006 (Pittman, 2009). The reservation currently consists of members of several bands including the Chakastaypasin Band who were originally from near Fenton, Saskatchewan, and the Peter Chapman Band who migrated to the area.

Problems in the Identification of Reading Disability Among Canadian First Nations

One of the consequences of the finding of relatively lower verbal ability among First Nations children is the overall lowering of intelligence scale scores. Thus, Full Scale IQ scores may be masked by language and experiential issues and this may lead to inaccurate diagnostic decisions when it comes to the identification of learning disabilities (Mushquash & Bova, 2007). This is especially the case when one considers the Discrepancy Model (DM) for the identification of learning disabilities. Given that the DM presumes a difference between overall IQ (in the average and above range) and achievement, one might expect that the particular pattern of cognitive functioning among First Nations populations might lead to the underidentification of learning disabilities. This is because traditional IQ tests may systematically disadvantage First Nations populations because of the higher verbal demands, among other construct or item biases. However, a frequent finding in the literature is that lower verbal ability may be related to difficulties in reading problems (Reynolds & Turek, 2012; Schneider & McGrew, 2012). Clearly, there is some need to explore the cognitive correlates of reading success and failure among Canadian First Nations populations.

An alternative model for exploring reading and reading disability identification which is framed from the PASS theory of intelligence is the Discrepancy–Consistency Model (Naglieri, 2000). The advantage of this model is that it can be used to identify children with specific learning disabilities utilizing an ipsative approach. That is, there should be some expected cognitive processing strengths that are discrepant from an area of academic weakness, but there might also be relative weakness in certain cognitive processes that are consistent with the academic weakness. In the case of reading, as mentioned above, we would predict that those who have specific reading disabilities (primarily at the word reading level) should show a relative and normative weakness primarily in successive processing. It remains to be seen whether this finding can be replicated and extended across two First Nations samples.

The objectives of this study were to (a) describe the cognitive processes and achievement levels of two similar but distinct First Nations groups, (b) test for similarities and differences in their cognitive profiles and the relationship of their cognitive profile to their reading ability, and (c) compare the poor reader subgroups within both samples to determine if they show the same pattern of weak successive processing as the primary deficit related to weak decoding. We hypothesized that the following:

Hypothesis 1: Some differences would be observed between two First Nations samples in terms of their cognitive abilities. This is due to the expected heterogeneity of First Nations groups.

Hypothesis 2: The same pattern of cognitive processing associated with low reading ability among Canadian First Nations children would be found, namely, low successive processing. Statistically, we would expect that successive processing would account for significant and independent variance in word decoding above and beyond variance explained by phonological awareness and rapid naming within a hierarchical regression analysis.

Hypothesis 3: There will be a difference in the ability of the DM versus the Consistency–Discrepancy Model (C-DM) to identify children with a specific learning disability in reading. We would specifically expect the DM to identify significantly fewer children with a possible learning disability.

Method

Alberta Sample

Eighty-four ($N = 84$) First Nations children in Grades 3 and 4 (ages 7.9-11.9 years, $M = 9.5$, $SD = .94$) were selected from a reservation school in Alberta, Western Canada. The sample consisted of 46 girls and 38 boys. All of the children for this study resided on the reserve.

As before, the Alberta School follows the English curriculum established by the province. Some instruction to learn Cree language has been recently introduced in the school. However, the medium of instruction is English. It is assumed that a vast majority of children within the school have English as their first language. As well, the exposure to Cree within the home environment is quite variable. The school district is a progressive one; it has adopted an early literacy program (i.e., Balanced Literacy) which has been continued for a few years prior to this study.

Saskatchewan Sample

Forty-nine ($N = 49$) First Nations children in Grades 3 and 4 (ages 8.25-11.08 years, $M = 9.4$, $SD = .73$) were selected from a reservation school in Saskatchewan. The sample consisted of 27 girls and 22 boys.

The Saskatchewan School follows the English curriculum established by the province of Saskatchewan. The Saskatchewan schools also have Aboriginal Language instruction and have made some adaptations to Language Arts instruction to accommodate First Nations and Metis students (see http://www.sasked.gov.sk.ca/branches/curr/evergreen/indlang.shtm).

The Alberta and Saskatchewan samples were part of a larger study supported by the Social Sciences and Humanities Research Council exploring reading ability and intervention. Chief, Band, and Education Council approval was first obtained and then informed consent was obtained from the parents of all participants. Consent was obtained from virtually all students in Grades 3 and 4 from the respective school system.

Measures

Individually administered tests included measures of cognitive functioning, word reading, phonetic skills, and rapid articulation as detailed in the following. The tests were administered by graduate-level research assistants trained and supervised by the authors. Testing typically took place in a quiet and semiprivate room within the school. All instructions were given in English. In terms of test order, the reading, and speed tests were given first during a separate sitting from the administration of the cognitive measures. Reading and speed tests could generally be completed within 10 to 15 min, whereas the cognitive measure generally took around 45 min to complete.

Cognitive measures. The Das–Naglieri Cognitive Assessment System (CAS; Naglieri & Das, 1997) was used to measure the four PASS factors. The Planning subtests of the CAS Basic Battery include *Matching Numbers* and *Planned Codes* and the Attention subtests comprised *Expressive Attention* and *Number Detection*. The Simultaneous subtests are *Nonverbal Matrices* and V*erbal Spatial Relations* and the Successive subtests include *Word Series* and S*entence Repetition*. The CAS has strong psychometric properties as reported by the test authors (Naglieri & Das, 1997). Each of the subtests is described next.

In the *Matching Numbers* subtest, children are presented with four pages containing eight rows of numbers. For each row, the child is instructed to underline the two numbers that are exactly the same. The time and number of correct matches for each page is recorded and the subtest score is calculated by combining time and number correct. As the length of the items increase from page 1 to page 4, participants need to adapt their strategies for efficiently finding the number pairs.

The *Planned Codes* subtest contains two pages, each with a distinct set of codes arranged in seven rows and eight columns. At the top of each page is a legend, which indicates how letters are associated with simple codes (e.g., A = OX; B = XX; C = OO). The child is instructed to fill in the correct code beneath each corresponding letter in any manner he or she chooses rather than recording the codes ploddingly from left to right in sequence. However, each page demands a specific strategy for more efficient performance. The subtest score is calculated by combining the time and number correct for each page.

The *Expressive Attention* subtest is quite similar to the Stroop Color and Word Test (Golden & Freshwater, 2002). Children are given three pages to complete. For the first page, the child reads color words (i.e., Blue, Yellow, Green, and Red). The words are presented in a quasi-random order. On the second page, the child is instructed to name the colors of a series of rectangles printed in aforementioned colors. On the third page, color words are printed in a different colored ink than the color the words name (e.g., the word Red may appear in blue ink). The child is required to name the color of the ink while resisting the interference from the color word. Thus for the prior example, the child who sees the word Red appearing in blue ink is required to say "Blue." The raw score is calculated using the time to complete the page and the number of correctly named colors.

The *Number Detection* subtest asks children to find the specific numbers among distracters. For the first page, the child is required to find the numbers 1, 2, and 3 printed in a specific font type and underline them on a page that contains numbers between 1 and 6 written in various font types. Only the numbers 1, 2, and 3 that are written with the target font type are to be underlined. Those with the wrong number or the wrong font type are to be ignored. The second page requires the child to find the numbers 1, 2, and 3 written in open font, and the numbers 4, 5, and 6 printed in bold font amid distracters. The subtest score is a ratio of accuracy (total number correct minus the number of false detections) to total time taken to complete all items.

Nonverbal Matrices is a subtest that is quite similar to other matrices types of tests on other cognitive batteries. Items present a variety of shapes and geometric designs that are interrelated through spatial or logical organization and presented within a visual matrix. For each item the child is required to decode the relationships and choose the best of six possible answers to complete the grid. Answers must be given within a 30-s time limit. The subtest score is calculated by adding up the total number of items answered correctly.

Verbal Spatial Relations measures the comprehension of logical and grammatical descriptions of spatial relationships. In this subtest, the child is presented with six drawings, arranged in a specific spatial manner along with a printed question that is also read aloud by the examiner. The child is instructed to choose one of the six drawings that best answers the question within the 30-s time limit. The subtest score is calculated by adding up the total number of items answered correctly.

Word Series is a successive processing measure that essentially tests memory for word order. The examiner reads the child a series of words that vary in length from 4 to 9 words, and then asks the participant to repeat the words in the same order. This subtest uses nine single-syllable, high-frequency words for items and these are all mentioned to the examinee prior to administering the individual items. The subtest score is the total number of word lists correctly repeated.

For *Sentence Repetition*, the child is read 20 sentences aloud and is asked to repeat each sentence verbatim. The sentences are unusual in that they are composed entirely of color words presented in a grammatically correct fashion (e.g., "The blue yellows the green"). Thus, this subtest requires order memory for words within a syntactic structure. The subtest score is the total number of sentences correctly repeated.

Reading measures. Children completed the Word Identification and Word Attack subtests from the Woodcock Johnson Tests of Achievement Third Edition (Woodcock, McGrew, & Mather, 2001). The Word Identification subtest involves the reading of individual words with some early items that require correct letter identification. Word Attack is a phonetic decoding task where the child is required to pronounce nonsense words. Scores in reference to a norm group reported for this article were relative to age-norms.

The Comprehensive Test of Phonetic Processing (CTOPP). The CTOPP (Wagner, Torgesen, & Rashotte, 1999) was also administered to each child and requires the rapid naming of color words, objects, digits, and letters. Also included were the Elision and Segmenting Words subtests. For the phonemic *Elision*, the child was presented a word and then asked to identify how that word would sound if a particular phonological segment was removed. *Segmenting Words* required the child to listen to a word spoken by the examiner, repeat it, and then identify the word one phonological sound at a time.

Results

Descriptive Results

Descriptive statistics for each sample are separately presented in Table 1. The Saskatchewan sample had significantly higher ($p < .05$) scores than the Alberta sample in several key areas: including Matching Numbers, Planned Connections, Number Detection, the Planning Scale, CAS Full Scale, Rapid Digit Naming, and the Elision subtest. When considering the stringent significance level required from applying the Bonferroni correction (.002), the *t* tests were still significant or very close for planning measures and the total planning score and also number detection. This supports our first hypothesis of significant differences between two First Nations samples given expected group heterogeneity.

Also analyzed was the incidence of poor decoders present within each sample. A poor decoder for this study was identified as having a standard score below 85 on Word Identification and on Word Attack. For the Alberta data set, 19 (22.6%) children met this criterion whereas 9 (18.4%) Saskatchewan children met this criterion. Regardless of which group, good readers were significantly higher in Planning ability, Attention, and Successive processing as well as Full Scale IQ (FSIQ).

The relationship between word decoding variables and cognitive processing variables for both samples are presented in Table 2. The full scale is significantly correlated with word reading and word attack and both groups had successive processing scores that were significantly related to word decoding. However, for the Saskatchewan group, there was also a significant relationship between planning and word decoding, as well as planning and word attack.

Comparison of various learning disabilities (LD) identification models in identifying reading disability

Consistency–Discrepancy Model. To analyze whether children met criteria for the C-DM model, the cognitive patterns, and the reading ability among the Alberta and Saskatchewan data sets were examined according to the Naglieri (2011) outlined steps. The first task was to identify those who were poor decoders. Low decoders were those who obtained either a Word ID and/or Word Attack standard scores at or below 85. We found that 28 of 131 (21%) cases met this criterion. The second step was to determine whether there was a normative and relative weakness in successive processing for the entire sample. However, the mean CAS standard score for the entire First Nations sample on the Successive scale is 88.4, which is considered low average. Thus, we had assumed that for the present sample, a Successive score below 85

Table 1. Means, Standard Deviations, and *t*-Test Results for Alberta and Saskatchewan Samples.

	Alberta			Saskatchewan			
Subtest	*M*	*SD*	*n*	*M*	*SD*	*n*	*t* test
Reading measures							
Word Identification (Standard)	84.46	14.58	84	88.41	12.04	49	*ns*
Word Attack (Standard)	91.55	14.47	82	95.04	11.97	49	*ns*
Rapid Naming Measures							
Rapid Letters (Scaled)	8.23	2.75	84	8.63	2.28	49	*ns*
Rapid Digits (Scaled)	7.75	2.33	84	8.59	2.28	49	0.04
Rapid Colors (Scaled)	6.98	2.82	84	7.45	2.53	49	*ns*
Rapid Objects (Scaled)	6.56	3.16	84	6.71	2.58	49	*ns*
Elision	7.00	1.91	84	8.67	3.19	49	.003
Segmenting Words	10.98	2.05	84	10.82	2.49	49	*ns*
Cognitive Measures							
Matching Numbers (Standard)	7.66	2.38	85	9.24	2.50	49	.001
Planned Connections (Standard)	8.36	2.28	85	9.59	2.03	49	.002
Planning Scale	88.04	11.21	85	95.98	12.01	49	.000
Nonverbal Matrices (Standard)	8.52	2.69	85	8.47	2.69	49	*ns*
Verbal Simultaneous (Standard)	9.00	2.57	85	9.24	2.54	49	*ns*
Simultaneous Scale	92.22	12.28	85	92.71	12.25	49	*ns*
Expressive Attention (Standard)	9.23	2.45	83	9.02	2.25	49	*ns*
Number Detection (Standard)	8.77	2.80	84	10.27	2.39	49	.001
Attention Scale	93.95	12.14	83	97.55	11.40	49	*ns*
Word Series (Standard)	8.72	2.54	85	8.80	2.76	49	*ns*
Sentence Repetition (Standard)	7.01	2.88	85	7.53	2.27	49	*ns*
Successive Scale	87.87	12.80	85	89.53	12.96	49	*ns*
Full Scale score	86.32	12.32	84	91.49	12.06	49	.02

Note. All scores are standard (*M* = 100, *SD* = 15) or scaled scores (*M* = 10, *SD* = 3). *ns* = not significant at the .05 level.

would signify a normative weakness in Successive processing. For the entire sample, we identified 45 out of the total number of 131 cases who fit this criterion. Examining them case by case, we calculated the mean of all 4 CAS standard scores for each individual and checked if his or her Successive score was at least 10 points below the mean. Twenty-seven out of 45 cases (60%) fit this criterion, and showed a relative and normative cognitive weakness in Successive processing. We then examined which of the children with a relative or normative weakness in successive processing also had a weakness in either Word ID and/or Word Attack. A total of 18 out of the 27 (67%) cases were found to be poor word decoders. Thus for the combined sample, there was a .67 probability of finding a poor reader when they had a relative and normative weakness in successive processing. Presumably, these would be the

Table 2. Intercorrelations Between Word Reading and Cognitive Variables for the Alberta (AB) and Saskatchewan (SK) Samples.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	AB	—														
	SK															
2	AB	.88**	—													
	SK	84**														
3	AB	.23*	.10	—												
	SK	.42**	.41**													
4	AB	.07	.06	.23*	—											
	SK	.37**	.34*	.61**												
5	AB	.21	.25*	.32**	.01	—										
	SK	.01	.02	.25	.12											
6	AB	.08	.03	.11	.04	.15	—									
	SK	.28	.28	.20	.12	.21										
7	AB	−.06	−.06	.17	.39**	.13	.17	—								
	SK	.25	.22	.38**	.29*	.08	.24									
8	AB	.34**	.30**	.42**	.34**	.10	.14	.13	—							
	SK	.20	.23	.22	.38**	.07	.26	.25								
9	AB	.30**	.30**	.12	−.06	.23*	.33**	−.11	.18	—						
	SK	.38**	.38**	.27	.33*	.20	.18	−.08	.26							
10	AB	.39**	.51**	−.12	−.01	.19	.15	−.16	.17	.42**	—					
	SK	.51**	.52**	.23	.24	.09	.15	.13	.33*	.59**						
11	AB	.21	.12	.78**	.77**	.19	.08	.36**	.53**	.01	−.09	—				
	SK	.54**	.54**	.54**	.84**	.16	.23	.35*	.40**	.41**	.27					
12	AB	.21	.21	.28*	.03	.78**	.73**	.21	.21	.34**	.21	.22*	—			
	SK	.23	.26	.27	.13	.74**	.78**	.17	.27	.30*	.21	.27				
13	AB	.21	.18	.39**	.47**	.14	.19	.71**	.78**	.04	.01	.60**	.28*	—		
	SK	.34*	.36*	.32*	.38**	.05	.35*	.71**	.82**	.17	.33*	.48**	.31*			
14	AB	.44**	.52**	−.002	−.05	.24*	.27*	−.15	.26*	.80**	.85**	−.02	.35**	.09	—	
	SK	.51**	.53**	.24	.30*	.14	.21	−.01	.35*	.91**	.86**	.42**	.31*	.30*		
15	AB	.41**	.40**	.52**	.43**	.51**	.50**	.40**	.66**	.50**	.42**	.64**	.70**	.72**	.59**	—
	SK	.56**	.58**	.60**	.58**	.39**	.54**	.41**	.63**	.65**	.63**	.76**	.66**	.71**	.73**	

Note. 1 = Word ID; 2 = Word Attack; 3 = Matching Numbers; 4 = Planned Connections; 5 = Nonverbal Matrices; 6 = Verbal Simultaneous; 7 = Expressive Attention; 8 = Number Detection; 9 = Word Series; 10 = Sentence Repetition; 11 = Planning; 12 = Simultaneous; 13 = Attention; 14 = Successive; 15 = CAS Full Scale.
*p < .05 (two-tailed). **p < .01 (two-tailed).

children who would potentially be identified as having a specific reading disability using the Naglieri model. We then looked at whether they also showed a discrepancy between one or more of the other PASS processes. We found that 17 children showed a discrepancy with at least one process, 13 showed a discrepancy with at least two processes and 6 showed a discrepancy with all other PASS processes with the exception of successive processing.

Discrepancy model. The combined sample of First Nations children was examined for the incidence of reading disability according to the traditional DM for identifying an LD. DM states that a child should have an average overall intelligence as well as an unexpected or discrepant failure in reading. There are two primary methods for calculating discrepancies which include a simple difference

Table 3. Frequencies of Children Identified as Having a Reading LD Based on the Consistency–Discrepancy Versus the Discrepancy Model.

	1.0 *SD* Discrepancy Model(*n*)	1.5 *SD* Discrepancy Model(*n*)	Consistency–Discrepancy Model(*n*)
LD[a]	13	9	18
LD[b]	8	6	

Note. LD = learning disabilities.
[a]For Discrepancy Model: Using Full Scale IQ = 80 or greater.
[b]For Discrepancy Model: Using Full Scale IQ = 85 or greater.

method and a regression method (Kavale, 2002). For this study, we chose to apply the simple difference method. In applying the simple difference method, and in the absence of an agreed on absolute value of discrepancy, we decided to apply a minimum of 1 standard deviation difference (i.e., 15 standard score points) as well as a 1.5 standard deviation difference (i.e., 22.5 standard score points) between the overall intelligence on the CAS and measures of achievement. We first examined the entire sample to determine which subjects met the criteria for sufficiently low reading ability. Given this, we knew that 28 subjects were low in Word ID, Word Attack, or both. Given that the mean FSIQ for the entire sample was 88.8 (*SD* = 11.5), we chose to use a less-stringent IQ cutoff (IQ $\geq$ 80) as representing average or normal intelligence. We then examined each of the 28 low decoders to determine if they also had average intelligence. After doing this, we found that 15 children met this criterion. This represented those who may possibly be LD if they also met the criteria for discrepancy. We then calculated the discrepancy between FSIQ and Word ID and Word Attack using a 1.0 and a 1.5 standard deviation criterion. We found that 13 and 9 children were discrepant in either Word ID and/or Word Attack at the 1.0 and 1.5 *SD* criterion, respectively. The relative identification of those with a reading LD comparing the two models are presented in Table 3. The Pearson χ^2 analysis approached significance in comparing the various models and the frequency of identification of LD ($\chi^2 = 5.823$, $p = .054$). Generally, this was realized in terms of fewer subjects identified as LD than expected using the 1.5 standard deviation DM. Thus, our hypothesis that significantly fewer children would be identified using the DM is rejected. However, as we used a rather liberal definition of what constituted average or better cognitive performance, we reanalyze the DM using a Full Scale IQ cutoff of 85 or higher and found the numbers drop to 8 and 6 for the 1.0 and 1.5 standard deviation criterion, respectively. Using these frequencies, the χ^2 is 12.519 and is significant ($p = .002$).

Multiple Regression Results

This analysis was carried out to examine whether CAS variables significantly predicted Word ID and Word Attack. Previously shown was that successive processing

Table 4. Results of Hierarchical Regression Analyses With PASS and Rapid Naming Speed as Independent Variables and Word Identification as the Dependent Variable for the Alberta and Saskatchewan Samples.

		Alberta		Saskatchewan	
Step	Variable	β	ΔR^2	β	ΔR^2
1.	Planning	.146	.242***	.374*	.394***
	Attention	.088		.054	
	Simultaneous	.012		.011	
	Successive	.430***		.334*	
2.	RAN Digits	.318*	.246***	.441*	.134***
	RAN Letters	.265		.210	
1.	RAN Digits	.387**	.380***	.262	.479***
	RAN Letters	.265		.456*	
2.	Planning	.025	.09**	.144	.114*
	Attention	−.016		−.225	
	Simultaneous	−.023		.060	
	Successive	.378***		.293*	

Note. PASS = Planning, Attention, Simultaneous, and Successive; RAN = Rapid Automatized Naming.
*p < .05. **p < .01. ***p < .001.

significantly predicted Word ID for the Alberta sample (Das, Georgiou, & Janzen, 2008). The question here was whether the same would hold true when adding the Saskatchewan sample to the analysis. Based on our past study and the correlational analysis from this study, CAS variables were entered in the following fixed order; successive, planning, attention, and simultaneous. For the entire sample, successive processing contributed significantly to the variance in Word ID (R^2 = .215, p = .000). At Step 2, planning added significant variance to the model (ΔR^2 = .068, p = .001). At each step successive processing and planning contributed a significant proportion of the variance in Word ID.

When this analysis was repeated for the two groups separately, the contribution of successive processing was significant for the Alberta and Saskatchewan groups for all steps in the model. However, for the Alberta group, planning only contributed significant variance at the end of Step 2. For the Saskatchewan group, planning and successive processing were significant predictors throughout the model. See Table 4 for the prediction of Word Identification from CAS variables and Rapid Naming variables for each group separately.

Performing the same multiple regression analysis with Word Attack as the dependent variable produced similar results to those of Word ID as the dependent variable. Successive processing contributed significantly to the proportion of variance in Word Attack and its contribution was significant at each step in the model (ΔR^2 = .270) for the entire sample. Planning only contributed significantly at Step 2 when it was entered

Table 5. Results of Hierarchical Regression Analyses With PASS and Rapid Naming Speed as Independent Variables and Word Identification and Word Attack as the Dependent Variable for the Combined Alberta and Saskatchewan Sample (*N* = 129).

		Word ID		Word attack	
Step	Variable	β	ΔR^2	β	ΔR^2
1.	Rapid Digits	.376***	.416***	.324*	.266***
	Rapid Letters	.303**		.219	
2.	Planning	.080	.104***	.042	.161***
	Simultaneous	.011		.015	
	Attention	−.095		−.029	
	Successive	.319***		.408***	
1.	Planning	.228*	.292***	.142	.311***
	Simultaneous	.014		.016	
	Attention	.062		.084	
	Successive	.409***		.472***	
2.	Rapid Digits	.367	.228***	.291*	.116***
	Rapid Letters	.228		.128	

Note. PASS = Planning, Attention, Simultaneous, and Successive.
*p < .05. **p < .01. ***p < .001.

into the model, but by Step 3 it no longer contributed significantly to the prediction of variance in Word Attack.

To determine whether CAS variables contributed significantly to variance in Word ID and Word Attack ability, beyond that contributed by Rapid Naming, the sample was combined to allow for greater statistical power. Group differences notwithstanding, there is considerable similarity of these two groups that allow us to combine these groups meaningfully for analysis. Phonological awareness variables are generally considered to be primary in predicting variance in reading, though Rapid Naming has consistently shown it also contributes significantly and independently to predicting variance in reading. In this case, the variables chosen for Rapid Naming include Rapid Digits and Rapid Letters. These variables showed the highest correlation with Word ID (*r*s = .62 and .60) as well as Word Attack (*r*s = .50 and .48). Rapid Naming variables as a block were entered first followed by PASS variables and then reversed. Results from this analysis are presented in Table 5 showing that mainly successive processing contributed significant variance to word reading and word attack for the entire sample. PASS variables accounted for approximately 10% of unique variance in word reading even after Rapid Naming variables were entered into the regression. Similarly, PASS variables accounted for 16% of unique variance in Word Attack after Rapid Naming was entered. The other finding of note is that for the entire sample, only Planning contributed to the variance in Word ID when it was entered prior to Rapid Naming variables, but not afterwards. Given the results from Table 4, it is possible that Planning may play a greater role in explaining variance in reading for the Saskatchewan group.

Discussion

Our results did show that there are generally more similarities than differences in terms of the cognitive and achievement profiles of the two First Nations groups of children. At the same time, some of the group differences are significant and may have psychoeducational implications for how we understand the reasons for academic success or failure.

There are some particular group differences that are observable in the cognitive patterns between these two First Nations groups, despite many surface contextual similarities. In this case, the main difference was realized in higher planning ability scores and a greater role for planning in the prediction of reading ability (Word Identification and Word Attack) for the Saskatchewan First Nations sample. The reasons for the difference in the relative contribution of planning to explain the variability in reading for one First Nations group and not the other would only be speculative at this point and thus is a matter for future research. This difference between groups does confirm the general impression that various First Nations groups are heterogeneous and thus one might expect within- and between-group variability in cognitive and achievement testing results.

Another difference was that the Saskatchewan group had higher scores for phonemic elision than the Alberta group and was significantly faster in Rapid Digit Naming. These phonological awareness skills might be partly related to a greater educational emphasis on these skills in Saskatchewan. One important implication of finding such group differences between two First Nations samples is to remind assessors that First Nations groups are heterogeneous and one should be careful not to assume homogeneity in interpreting test results.

Another finding of interest is that both groups showed relatively average phonological processing ability (i.e., Word Attack), while their overall ability to decode individual words fell in the low-average range. For the entire sample, there were 29 children (20%) who were low in word reading and nonsense word reading (i.e., Word Attack), that signals there was a relatively high proportion of children who would be considered poor decoders. It might be expected that only 6.7% of the population should have scores below 80. Thus, we see an overrepresentation of children considered to have low reading achievement using a norm-referenced comparison. In this case, there was 3 times the incidence of low decoding ability among First Nations children.

The finding of low-average decoding for First Nations children raises the issue of identification. If we were to use the present data as representative of First Nations achievement, then 1 standard deviation below the combined sample mean for these First Nations groups would be equivalent to a standard score of 73.8. Does this mean that only reading scores below a standard score of 75 be used to identify those First Nations children who are truly "low" in word reading? The consequences of using a within-sample cutoff in this manner could be the overall lowering of expectations for First Nations children's achievement. That is, if we consider a child with a word identification score of 85 to be "average" relative to other First Nations children rather than low average (as they would be considered relative to normative comparisons), do we then not offer any additional reading supports or interventions? Clearly, there are reasons why this would not be advisable.

A corollary to this point is the identification of LD using the DM. Challenges to the DM have already been well documented and include such things as regression to the mean, the unreliability of discrepancy scores, and the finding that low readers do not differ based on whether they demonstrate an IQ-achievement discrepancy (Vellutino, Scanlon, & Lyon, 2000). From our findings of 131 students, we identified only 28 who were poor decoders. Of this 28 students, 13 met criteria for "average" intelligence (FSIQ = 80 or above) while having at least a 1 standard deviation difference between intelligence and decoding ability. However, if we used a 1.5 standard deviation discrepancy criterion, we could only identify 9 students as having a reading disability. Should we have utilized a definition of average or better intelligence where a standard score of 85 or better-represented normal intelligence, then we would only identify 8 and 6 children, respectively. Clearly, among this population, this model is problematic for identifying a learning disability and is most likely to underidentify children as reading disabled using more traditional definitions of discrepancy.

In contrast, the C-DM proposed by Naglieri (2011) was able to identify 18 out of the 28 children (64%), who demonstrated poor decoding as potentially having a disability in reading. Thus, our hypothesis that the DM would identify fewer children as LD relative to the C-DM was confirmed. The potential advantage of utilizing the C-DM approach for identifying LD among such groups as First Nations children is that it utilizes an ipsative approach to determine a relative weakness in a specific cognitive process. Thus, a relative weakness could be identified irrespective of normative performance. At the same time, this approach states that one also needs the cognitive processing to be weak relative to the test norms. In this case, the same problem exists for this model in trying to determine normative weakness for successive processing. Here, the First Nations sample was normatively low average on successive processing ($M = 88.4$, $SD = 12.6$). Thus, one is still faced with the quandary of determining what constitutes normatively low average when the population as a whole appears to be below average according to normative comparisons.

The question remains as to which decision model, if either, is more valid and clinically useful in the identification of children with a possible learning problem. On one hand, the DM would potentially underidentify students while using local norms might lead to identifying a student as LD when other factors might better account for both their reading achievement failure and their lower cognitive performance. These factors might include socioeconomic factors, cultural factors, home–school culture mismatch, curriculum mismatch, poor teacher training, home literacy factors, English as a Second Language factors, to name a few.

On the other hand, if every First Nations child with a reading score below 85 was deemed in need of more reading intervention, this would mean the need to increase teaching and support staff and other resources necessary to support reading. In an economic climate where resources are limited, perhaps, the solution is more about making sure the overall curriculum is culturally relevant (Stokes, 1997), attempting more preventive and school-wide literacy initiatives, and ensuring "buy-in" from parents and the larger community to support literacy.

Many of the usual relationships that tend to be observed and reported between reading and phonological awareness and rapid naming were also observed for both First Nations groups. For example, relative and normative weaknesses in successive processing tended to predict poor word reading for both groups. This corresponds to what other researchers have reported for both First Nations samples (Das et al., 2008; T. Janzen, 2000) and non–First Nations samples (Das et al., 1996; Kirby et al., 1996; Kirby & Williams, 1991). Indeed this same relationship has also been found cross-culturally for Spanish (Molina, Garrido, & Das, 1997) and Greek children (Papadopoulos, Charalambous, Kanari, & Loizou, 2004).

Also as expected, phonological awareness variables and rapid naming were the strongest predictors of reading achievement for First Nations children. This supports what has been repeatedly found in reading literature that suggests that phonological ability is core to reading and specific learning disabilities (Shaywitz & Shaywitz, 2005; Torgesen, Wagner, & Rashotte, 1994), and that RAN also contributes unique variance in reading (Berninger, O'Donnell, & Holdnack, 2008; Wolf & Bowers, 1999). In this case, our results demonstrated that successive processing also explains significant, though small, variance in reading ability among Canadian First Nations children. This finding of a consistent relationship between reading processes, cognitive processing, and reading achievement lends further support to using identification models that are based on sound theory and research. In this case, our results suggest that the C-DM model may have certain advantages for the identification of LD among First Nations populations for identifying reading disability compared with the traditional DM.

These results should be viewed with caution and only as preliminary, as the sample sizes were not large and were based on only two groups of Cree First Nations children. While every effort was made to administer the tests following standardized procedures, the two different locations may have produced some subtle accommodation differences. Greater attention also needs to be paid to demographic variables (SES and parental education in particular), educational programs, and other cultural and linguistic factors that might impact performance on cognitive tests as well as reading skills. Our results suggest that it is quite possible and might be expected that we will find many specific differences in the cognitive and achievement profiles of various First Nations groups given the heterogeneous nature of First Nations population. This study did not explore some of the more contextual factors that might contribute to the cognitive and achievement results which could be the most salient factors that contribute to normative weaknesses in cognitive and achievement testing. Contextual factors that are useful to explore might include (but are not limited to) home literacy, poverty, attitudes to education (and reading), and culture/education practices. Exploring such factors is a matter for future research. Also, a reading comprehension measure was not utilized for the present research and thus it remains a matter for future research to explore the cognitive processing relationship to reading comprehension among First Nations populations.

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