

## Research Article

# Exploring Historical and Contemporary Academic Disparities: A Comparative Study of Black and Non-Black Nova Scotians

John Fuerst<sup>1</sup>, Meng Hu<sup>1</sup>

1. University of Maryland, College Park, United States

In Canada, concerns persist regarding the academic underperformance among historically marginalized racial and ethnic groups. Extensive research has been conducted on the academic achievements of Aboriginal communities, but there's a noticeable lack of focus on longstanding Afro-descendant populations. Our study aims to address this gap by examining discrepancies in numeracy and overall academic performance, particularly between Black and non-Black residents of Nova Scotia. Utilizing historical census data, we identified a small-to-medium sizes numeracy gap between European and African Nova Scotians, measuring about one-third of a standard deviation, prevalent in the late 19th and early 20th centuries. Furthermore, contemporary data from the 21st century reveals a gap in academic and cognitive test scores between African and other Nova Scotians of approximately half a standard deviation. We analyze these findings in the context of existing research on racial and ethnic academic disparities in the Americas.

**Correspondence:** [papers@team.qeios.com](mailto:papers@team.qeios.com) — Qeios will forward to the authors

## 1. Introduction

In Canada, there are ongoing concerns regarding race-related academic achievement disparities. These concerns primarily focus on the performance gaps between White Canadians and historically marginalized groups, including Aboriginals (First Nation, Inuit, and Metis) and long-established Afro-descendant communities, such as Black Nova Scotians from non-recent migrant backgrounds. Although the academic disparities between Aboriginal and non-Aboriginal groups have been extensively studied

(Richards, 2020; Yore et al., 2014), the gaps involving other racial and ethnic groups, particularly those of Afro-descent, remain under-researched (Mayor & Suarez, 2019). Mayor & Suarez (2019) attribute this gap in research, in part, to Canada's reluctance to disaggregate racial data at the national level.

Studying the academic achievements of long-established Afro-descent communities is further complicated by the rapid growth of the Black Canadian population. As of 2021, there were approximately 1.5 million self-identified Black Canadians, over half of whom were born abroad. This recent demographic shift can blur the lines between immigrant- and race-related academic impacts (Cox, 2021). For instance, the overall educational attainment of the Black population in Canada is on par with the non-Black population, largely due to the influx of highly educated economic immigrants; however, this situation contrasts sharply with that of third-or-higher generation Black Canadians, who generally exhibit lower educational attainment than the national average (Wall & Wood, 2023).

A particular area of concern, highlighted by the UN Human Rights Council (2017), is the academic performance of Black Nova Scotians, especially those from long-standing communities. While, according to the 2016 census, only 9 percent of Black Canadians are of the third generation or more, this figure rises to 72 percent among Black Nova Scotians. This region has the highest concentration of third-generation or more Black individuals, who are primarily descendants of Black Loyalists, Black Refugees from the USA, and Jamaican Maroons who settled in Nova Scotia before the 19th century.

The subpar educational outcomes of Blacks in Nova Scotia, particularly from historic communities, have been underscored in various reports over the past three decades, starting with the Black Learners Advisory Committee (BLAC) (1994) report. As the BLAC report noted, historic Black communities were socially marginalized, with school segregation ending only in the 1970s. The UN Human Rights Council's (2017) report pointed out the unchanged educational inequities between African Nova Scotians and other Nova Scotians even after 30 years of school integration. It highlighted the poor socioeconomic conditions and limited access to post-secondary education among African Nova Scotians.

The UN committee proposed a number of recommendations, including tracking race/ethnic-based inequalities for the purpose of informing intervention strategies and addressing the relatively low academic achievement of African-descent groups. Since the magnitude of the contemporaneous Black / non-Black Nova Scotian achievement gaps is rarely quantified we do so in this paper, in line with the UN committee recommendations. The purpose is to better understand the test score gaps, specifically between historically marginalized groups and other Canadians, so as to inform policy.

To provide historical context, we first examine numeracy gaps between Black, White, and Indigenous Canadians and Nova Scotians in the early 1900s using the age-heaping methodology (e.g., Fuerst & Hu, 2023). We then compute achievement gaps based on Nova Scotia provincial math and reading tests taken between 2013 and 2023. Finally, we calculated means for cognitive/achievement tests tapping verbal ability based on data reported in a recent dissertation by Cox (2021). Our discussion situates these results within the broader context of research on racial and ethnic academic differences across the Americas.

## 2. Data and method

### *2.1. Historical age-heaping-based numeracy estimates*

For this study, we utilized historical census data from the Integrated Public Use Microdata Series (IPUMS) dataset (Minnesota Population Center, 2020). Our analysis focused specifically on the census years 1881, 1901, and 1911, as these years included questions about the “origin” or “Racial or tribal origin” of the respondents. To categorize individuals, we employed the following criteria: an individual was classified as White/European if they were listed as originating from a European ethnic group in 1881, or if they identified as “White” in the 1901 or 1911 censuses. Similarly, an individual was classified as Black/African if they were reported as originating from Africa in 1881, or if they identified as “Black” in the 1901 or 1911 censuses. For Indigenous identification, a person was labeled as Indigenous if they were noted as belonging to an Indigenous tribe or if they were marked as “Indigenous” in any of the three census years. It’s important to note that race/ethnicity is also reported in the 1991 and later censuses. However, by this time, the accuracy of age reporting had substantially improved in Canada, rendering age-heaping an ineffective method for estimating numeracy differences. Therefore, our analysis did not extend to these later census years where age-heaping could not be used as a reliable measure.

Following the methodology of Fuerst & Hu (2023), our analysis was confined to individuals aged 23 to 62. This age range is identified as the most stable for calculating age-heaping using the Whipple Index (Szotkysek et al., 2018). Additionally, to minimize the influence of potential language bias, we focused solely on Canadian-born individuals. Our analysis concentrated on male respondents to avoid interactions between sex and age-heaping effects. We evaluated the levels of age-heaping among White, Black, and Indigenous populations both across Canada and specifically within the province of Nova Scotia. We further explored the extent of age-heaping among individuals who were either literate

(defined by the Census as being able to read and write) or illiterate, though it's important to note that the literacy variable was only available in the 1911 census for the Canadian population.

To estimate numeracy levels based on age-heaping, we calculated Whipple index scores. The Whipple index is determined by summing the number of persons reporting ages ending in 5 or 0, dividing this total by the sum of all persons surveyed, and then multiplying by 5. The formula for the Whipple index is as follows:

$$WI = 5 * \frac{P25 + P30 + P35 + \dots P60}{P23 + P24 + P25 + \dots P62} * 100$$

where W is the Whipple index.

The Whipple index can be transformed into an index, called ABCC, which is an estimation of the proportion of the population that can accurately report ages, without rounding. The formula for ABCC is:

$$ABCC = \left(1 - \frac{WI - 100}{400}\right) * 100$$

where WI is the Whipple index.

The ABCC index can be transformed into a standard-deviation-unit metric, using an inverse cumulative transformation, which Reardon and Ho (2015) denote as *dtpac*. The formula for *dtpac* is:

$$dtpac = \Phi - 1(ABCC_a/100) - \Phi - 1(ABCC_b/100),$$

where  $ABCC_a$  and  $ABCC_b$  are the ABCC variables for population a and b, respectively. On the assumption of normality and equal variances, *dtpac* is equivalent to Cohen's *d* (Reardon and Ho, 2015).

Analyses were performed in R, using the following packages: ipumsr, dplyr, simPop, psych. We used the `whipple()` function of the `simPop` package. Sampling weight (variable PERWT) was applied as recommended by the IPUMS. This approach allowed us to provide a more representative and accurate analysis of the census data, particularly in the context of age-heaping and numeracy assessments.

## 2.2. Nova Scotian provincial math and reading achievement tests

Data pertaining to math and reading test scores were acquired from the Nova Scotian Department of Education and Early Childhood Development, covering assessment years from 2013-14 to 2022-2023. This data encompasses results from students in grades 3, 6, 8, and 10. The Department categorizes the data based on students' self-reported African heritage and other demographic groups. The dataset includes

the number of participants and the percentage of students scoring at or above the expected performance level.

To analyze this data, we converted the percentages of students meeting or exceeding expectations into *dtpac*-values. This conversion was done using the NORMINV function in Excel, which calculates the inverse of the normal cumulative distribution. To ensure the accuracy of our estimates, we compared our *dtpac*-values with the *d*-values for the 2013-2014 academic year. This comparison was feasible as Kakembo et al. (2014) had previously reported math and reading test score means for grades 3/4, 6, and 8. We found that the averaged *dtpac* and *d*-values across grades and subjects were identical to two significant digits. This consistency suggests that our *dtpac* estimates are unbiased representations of *d*-values, at least for the 2013-14 year.

In line with Sackett and Shen (2010), we also computed composite scores. Composite scores take into account the correlations between subtests, and are more equivalent to full-Scale IQ scores. The specific formula for computing these composite scores is detailed in Sackett and Ellingson (1997):

$$d = \frac{\sum_{i=1}^k d_i}{\sqrt{(k + k(k-1)r_{ii})'}}$$

where  $d_i$  is the *d*-value for each predictor,  $k$  is the number of predictors, and  $r_{ii}$  is the average correlation between predictors.

When the average correlation between subtests is lower than zero, the composite differences will be larger than the average of the predictor *d*-values. For the correlation between math and reading subtests, we used  $r = .70$ , which is approximately the correlation found between math and reading achievement tests found in large, general population samples.

### 2.3. Literature search and the Adena Cox (2021) study

We conducted a literature search for research papers on test score differences in Nova Scotia. We were able to identify three papers: Thiessen (2009), Girgulis et al., (2021), and Cox (2021). We were unable to obtain Thiessen's (2009) report, which concerned math and reading achievement tests scores of Nova Scotian pupils. Girgulis et al. (2021) reports MCAT z-scores for small groups of Black, Indigenous, and Other applicants to Dalhousie University medical school in Nova Scotia. However, these groups included both non-Canadians and also individuals from other regions of Canada, and so we excluded this paper from consideration.

Finally, Cox (2021) studied 338 students recruited from 18 public schools in Nova Scotia. Data collection took place between January and May of 2019. Students were given five different cognitive/achievement tests tapping verbal ability, namely, the Sight Word Efficiency and Phonemic Decoding Efficiency from the Tests of Word Reading Efficiency 2<sup>nd</sup> Edition (TOWRE-2), Word Identification and Passage Comprehension from the Woodcock Reading Mastery Test 3<sup>rd</sup> Edition (WRMT-III) and finally, the Peabody Picture Vocabulary Test 5<sup>th</sup> Edition (PPVT-5). Missing data was not substantial but not small either, with 15.09% of the 338 students who did not complete one or more subtests. All students were in the English stream and were in 1st grade at the time of assessment, with mean age of 81.68 months (SD=3.76). 79% of the students were born in Canada. 82% of the students have families who speak English at home. Using this data, we compare cognitive differences between immigrant Africans, African Nova Scotians, and non-African Nova Scotian students.

### 3. Results

#### 3.1. Historical age-heaping based numeracy estimates

Table 1 presents the ABCC values for the three racial groups, along with the standardized group differences, equivalent to Cohen's *d*. The data reveals small-medium to large disparities in numeracy levels across racial groups in Canada during the late 19th and early 20th centuries.

In 1881, Canada exhibited a Black-White numeracy gap (*dtpac*) of 0.32 and an Indigenous-White gap of 1.18. Comparatively, in Nova Scotia, these gaps were 0.36 for Black-White and -0.14 for Indigenous-White. This indicates that while the Black-White gap was slightly larger in Nova Scotia than in the rest of Canada, the Indigenous-White gap was notably smaller and even reversed in direction. For context, the Black-White numeracy difference in the United States in 1880 was substantially larger, at *dtpac* = 1.08, as noted by Fuerst and Hu (2023).

By the years 1901/1911, the dynamics shifted. The Black-White and Indigenous-White gaps in Canada were 0.71 and 0.98, respectively. In Nova Scotia, these gaps were 0.37 for Black-White and -0.09 for Indigenous-White. This demonstrates smaller gaps within Nova Scotia. In the United States, the corresponding Black-White and Indigenous-White gaps in 1910 were 0.79 and 1.09, respectively. Therefore, by the early 20th century, the magnitude of the Black-White and Indigenous-White numeracy differences in Canada had become comparable to those in the US. However, Nova Scotia continued to show substantially smaller or even reverse gaps, particularly in the case of the Indigenous population.

Interestingly, focusing only on literate individuals in the sample did not substantially alter the mean numeracy scores for White and Black groups but did lead to an improvement in the numeracy scores of Indigenous individuals. This finding aligns with what was observed in the United States, suggesting a broader pattern in the impact of literacy on numeracy skills across different racial groups.

Year	Sample		White / European origin		Black / African origin		Indigenous origin		W/B <i>dpac</i>	W/I <i>dpac</i>
			N	ABCC	N	ABCC	N	ABCC		
1881	Canada	Literate/ illiterate	600993	94.16	2363	89.35	11266	65.13	0.32	1.18
1881	Nova Scotia	Literate/ illiterate	74452	93.15	1164	86.98	360	94.79	0.36	-0.14
1901	Canada	Literate/ illiterate	46148	97.25	165	86.36	929	80.33	0.82	1.06
1911	Canada	Literate/ illiterate	59136	95.89	146	86.47	925	78.92	0.64	0.93
1911	Canada	Literate	54093	96.14	119	86.13	362	86.33	0.68	0.67
1901/ 1911	Canada	Literate/ illiterate	105284	96.48	311	86.41	1854	79.63	0.71	0.98
1901/ 1911	Nova Scotia	Literate/ illiterate	9286	94.65	119	89.29	34	95.59	0.37	-0.09

**Table 1.** Age-heaping based numeracy differences between Whites and Blacks (W/B) and Whites and Indigenous (W/I) in 1881, 1901, and 1911 along with ABCC values for the three ethnic/racial groups.

*Note: A positive dtpac indicates that the White group has a higher score.*

### 3.2. Nova Scotian provincial math and reading tests

Table 2 in our study delineates the differences in math and reading test scores between Afro-descent and other students in Nova Scotia. This table breaks down the data by year and grade, providing a detailed view of the academic achievement gaps.

Our analysis of the data showed some variability in the score gaps, particularly in reading tests. However, there was no discernible trend over time within each grade level. Additionally, we did not observe any substantial increase or decrease in the achievement gaps across different grades within the same assessment year.

The *N*-weighted average Afro-descent-Other gap for math is  $dtpac = 0.48$ , and for reading, it is  $dtpac = 0.37$ . When these scores were combined into a composite gap, it resulted in  $dtpac = 0.46$ . For international comparison, this composite gap is approximately half the size of the Black-White gap observed in the United States (Sackett & Shen, 2010).

In a broader context, when comparing Nova Scotian performance on the PISA math and reading tests (conducted between 2012 and 2018) to the Canadian mean, Nova Scotians scored on average  $d = 0.16$  below. This statistic was derived from provincial means reported by Whitley & Hollweck (2020) and Canadian standard deviations provided by the National Center for Educational Statistics' International Data Explorer. Consequently, the average and the composite scores for Black Nova Scotians are  $dtpac = 0.58$  and  $0.63$ , respectively, below the Canadian mean, indicating a somewhat larger gap when compared to the national average.



	Year	Math <i>dtpac</i>	N	Reading <i>dtpac</i>	N	Composite <i>dtpac</i>
Grade 3&4	2013-14	0.42	350	0.43	274	0.46
Grade 3&4	2014-15	0.40	358	0.47	333	0.47
Grade 3&4	2015-16	0.59	405	0.44	384	0.56
Grade 3	2016-17	0.47	447	0.44	408	0.49
Grade 3	2018-19	0.36	495	0.38	418	0.40
Grade 3	2021-22	0.43	575	0.32	479	0.41
Grade 6	2013-14	0.49	274	0.21	294	0.38
Grade 6	2014-15	0.57	402	0.42	412	0.54
Grade 6	2015-16	0.45	398	0.36	405	0.44
Grade 6	2016-17	0.40	413	0.36	410	0.42
Grade 6	2017-18	0.55	443	0.45	445	0.54
Grade 6	2018-19	0.51	464	0.37	468	0.48
Grade 6	2019-20	0.48	557	0.45	549	0.50
Grade 6	2021-22	0.44	578	0.33	573	0.41
Grade 6	2022-23	0.39	622	0.33	626	0.39
Grade 8	2013-14	0.56	280	0.28	301	0.46
Grade 8	2014-15	0.59	372	0.36	408	0.52
Grade 8	2015-16	0.56	359	0.34	370	0.49
Grade 8	2017-18	0.53	427	0.40	441	0.51
Grade 8	2018-19	0.46	432	0.31	439	0.42
Grade 8	2021-22	0.52	581	0.32	591	0.46
Grade 10	2014-15	0.49	213	0.35	375	0.46
Grade 10	2015-16	0.41	212	0.21	362	0.33
Grade 10	2017-18	0.36	216	0.37	399	0.40

	Year	Math <i>dtpac</i>	N	Reading <i>dtpac</i>	N	Composite <i>dtpac</i>
Grade 10	2018-19	0.53	271	0.40	474	0.50
Grade 10	2021-22	0.48	315	0.52	496	0.55
N-weight average		0.48		0.37		0.46

**Table 2.** African/non-African math and reading test scores (*dtpac*) gaps among Nova Scotian Africans by grade and year.

### 3.3. Cox (2021) study

Table 3 in our study shows the differences in cognitive test scores as originally reported by Cox (2021, Table 1), along with Cohen's *d* values that we computed. This table offers a nuanced understanding of the cognitive performance disparities between African Nova Scotians and other Nova Scotian groups.

The data reveals that the Cohen's *d* gap between all individuals of African descent and all other Nova Scotians fluctuates between 0.35 and 0.65. More specifically, when focusing on African Nova Scotians from historic communities, denoted African NS, the *d* gap ranges from 0.58 to 1.06. When these scores are averaged across the five verbal tests, the gaps are  $d = 0.47$  for all Africans versus others, and  $d = 0.79$  for African Nova Scotians from historic communities versus others.

A particularly noteworthy finding is that African Nova Scotians with recent immigrant backgrounds, denoted African Other, tend to perform better on these cognitive tests than those from historic communities. This distinction highlights the varying educational outcomes within the African Nova Scotian population, underscoring the influence of factors such as immigration background and community history on academic performance.

Groups		TOWRE-2 SWE	TOWRE-2 PDE	WRMT-III WI	WRMT-III PC	PPVT-5
other NS	Mean	104.49	96.75	105.74	104.85	106.51
	SD	16.46	14.47	13.81	12.54	15.75
	N	248	228	238	247	239
African	Mean	98.21	90.4	100.83	96.5	97.96
	SD	18.3	18.24	17.99	16.53	11.09
	N	24	20	23	24	23
African NS	Mean	90.75	81.56	97.73	93.75	97.45
	SD	10.84	10.92	15.16	15.86	10.8
	N	12	9	11	12	11
African Other	Mean	105.67	97.64	103.67	99.25	98.42
	SD	21.62	20.22	20.51	17.42	11.81
	N	12	11	12	12	12
d gaps						
African/ other NS	0.38	0.43	0.35	0.65	0.56	
African NS/ other NS	0.85	1.06	0.58	0.87	0.58	
African other/ other NS	-0.07	-0.06	0.15	0.44	0.52	

**Table 3.** Cognitive test scores contrasting non-African and African groups in Nova Scotia.

*Note: Columns from left to right display scores for Test of Word Reading Efficiency 2<sup>nd</sup> ed. Sight Word Efficiency and Phonemic Decoding Efficiency, Woodcock Reading Mastery Test-III Word Identification and Passage Comprehension, and Peabody Picture Vocabulary Test-5.*

## 4. Discussion

In Canada, there are continuing concerns about the academic achievement of historically marginalized racial and ethnic groups, particularly within long-established Afro-descent communities, such as the

Nova Scotian Black population. Our research reveals that contemporary Black children in Nova Scotia score on average  $d_{pac\_composite} = 0.46$  below their peers from other racial/ethnic groups on provincial math and reading tests. To put this in perspective, this gap is roughly half the size of similar disparities found in the United States, where the  $d_{composite}$  ranges from 0.90 to 0.98, as reported by Sackett and Shen (2010).

Considering that Nova Scotians, in general, perform slightly below the Canadian average on international proficiency tests ( $d_{PISA} = 0.16$ ), the performance gap for Nova Scotian Black children becomes even more pronounced when compared to the Canadian average, approximating  $d \sim 0.63$ . This indicates a substantial disparity in academic achievement within the Nova Scotian context and when benchmarked against national standards.

Interestingly, the size of these achievement test gaps is similar to those reported for verbal ability tests, such as the Peabody Picture Vocabulary Test. This consistency across different types of assessments suggests a broader trend in educational disparities affecting this group.

Moreover, our historical analysis shows that age-heaping based numeracy gaps from the late 19th and early 20th centuries were smaller in magnitude ( $d_{pac} = 0.36$  to  $0.37$ ), despite the prevalence of more overt discrimination during that period. This finding suggests that the factors contributing to the current educational gaps are complex and may not be solely attributable to overt discrimination. The lesser gap in the past, in contrast to the present, raises questions about the evolution of educational disparities and the current systemic challenges faced by the Nova Scotian Black community.

The observed gaps in academic performance, particularly among descendants of historic Afro-descent communities in Nova Scotia, might be understated for a couple of key reasons. Firstly, a non-trivial portion of the Nova Scotian Black population, approximately 25%, consists of first or second generation migrants. Many of these individuals, or their parents, are highly educationally selected, as highlighted by Wall & Wood (2023) and Cox (2021). This selection bias means that these children, being products of a highly selective immigration process, are likely to perform better academically compared to those descended from less selectively immigrated populations (e.g., Cattaneo & Wolter, 2015).

The small sample sizes in existing research limit the conclusiveness of this observation, but the data from Cox (2021) provides some support for this hypothesis. These findings suggest a nuanced dynamic within the Nova Scotian Black community, where recent Black immigrants and their descendants, who might have benefited from a more rigorous educational background exhibit higher academic

performance than those from historic Afro-descent communities. This distinction is crucial for understanding and addressing the educational disparities within this population, and it highlights the need for more detailed and segmented data to accurately assess and respond to the educational needs of these diverse groups.

The second reason the academic gaps may be underestimated in the context of historic Afro-descent communities in Nova Scotia is the high rate of exogamy (marriage outside one's social group) among third-generation and beyond Black Canadians. This has likely resulted in a highly admixed Afro-descent identifying community, as suggested by visual evidence from sources such as student photographs in news reports covering events such as Black Excellence Day (e.g., Field, 2022).

This observation is supported by a substantial body of research, primarily from the USA and Latin America, which indicates that in traditionally Black communities, European admixture is often associated with better academic and educational outcomes (Fuerst and Hu, 2023; Fuerst & Kirkegaard, 2016). Similar findings have been reported in studies of historic Black communities in Kent County, Ontario (Tanser, 1939; 1941).

These outcomes align with the "inherited disadvantage" model proposed by Fuerst & Shibaev (2023), which posits that inequalities are largely transmitted vertically through cultural or genetic vectors. According to this model, an individual with a lower proportion of great-grandparents from a historically disadvantaged group (e.g., 1/8) would tend to perform better academically than an individual with a higher proportion (e.g., 4/8).

Therefore, if the focus is on addressing inequality linked to membership in historically marginalized groups, relying solely on self-identified race/ethnicity or ethnic membership might overlook a huge portion of academic disadvantage. This perspective underscores the importance of considering the complexities of racial and ethnic identity, particularly in admixed populations, when assessing and addressing educational disparities (Fuerst, Shibaev, & Kirkegaard, 2023).

Future research in this area should aim to disaggregate data based on migrant status and the degree of descent from traditionally marginalized communities. This more granular approach would provide a clearer understanding of the various factors influencing academic performance within these groups.

Additionally, it would be beneficial to compare the performance of African Canadians from provinces other than Nova Scotia. Such comparative data would offer valuable insights into regional differences and similarities in educational outcomes among African Canadian populations. This broader scope could help

identify specific challenges and successful strategies that might be unique to certain regions or shared across the country.

By incorporating these elements into future studies, researchers can develop a more comprehensive and nuanced understanding of the educational disparities faced by African Canadians, leading to more targeted and effective interventions.

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