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Résumé de l'article

Dans de nombreuses juridictions scolaires, les conseils scolaires utilisent des salles de classe préfabriqués pour accueillir les élèves dans les écoles surpeuplées. Malgré leur popularité, ni les contextes socio-économiques de leur utilisation ni leurs effets sur la réussite scolaire ne sont bien compris. Cette étude élargit la littérature naissante sur les salles de classe portables en rendant compte d'une étude qui a examiné l'utilisation des salles de classe portables dans les 27 plus grands conseils scolaires de la province canadienne de l'Ontario. Grâce à une combinaison de stratégies statistiques, cette recherche rend compte (a) des facteurs socio-économiques qui augmentent les chances d'avoir un nombre élevé de portables et (b) des facteurs associés à l'utilisation portable qui affectent la réussite scolaire. Sur la base de ces conclusions, le document propose des recommandations pour la politique et la pratique.

Portable Classrooms: Socioeconomic Context and Implications for Academic Achievement

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Abstract

Across many educational jurisdictions, school boards use portable classrooms to accommodate students in overcrowded schools. Despite their popularity, neither the socioeconomic contexts of their utilization nor their effects on academic achievement are well understood. This article expands the incipient literature on portable classrooms by reporting on a study that examined portable classroom use in the 27 largest school boards in Ontario, Canada. Through a combination of statistical strategies, this research reports on (a) the socioeconomic factors that increase the odds of having a high number of portable classrooms and (b) the factors associated with portable classroom use that affect academic achievement. Based on these findings, this article offers recommendations for policy and practice.

Keywords: Portable Classroom, School Overcrowding, Ontario, School Boards

Resume

Dans de nombreuses juridictions scolaires, les conseils scolaires utilisent des salles de classe préfabriqués pour accueillir les élèves dans les écoles surpeuplées. Malgré leur popularité, ni les contextes socio-économiques de leur utilisation ni leurs effets sur la réussite scolaire ne sont bien compris. Cette étude élargit la littérature naissante sur les salles de classe portables en rendant compte d'une étude qui a examiné l'utilisation des salles de classe portables dans les 27 plus grands conseils scolaires de la province canadienne de l'Ontario. Grâce à une combinaison de stratégies statistiques, cette recherche rend compte (a) des facteurs socio-économiques qui augmentent les chances d'avoir un nombre élevé de portables et (b) des facteurs associés à l'utilisation portable qui affectent la réussite scolaire. Sur la base de ces conclusions, le document propose des recommandations pour la politique et la pratique.

Mots clés : Salles de Classe Préfabriqués, Salles de Classe Portables, Écoles Surpeuplées, Ontario, Conseils Scolaires.

Introduction

Portable classrooms, also known as relocatable, mobile, or demountable classrooms, are a common sight in many school districts in Canada and the United States. Because of their flexible placement and relatively low upfront cost, these structures are often used when the built space in schools is insufficient to accommodate growing student populations. While meant to be temporary, these structures tend to stay on site for longer periods (Riveros, 2023; Chan 2009), which suggests that, in the context of austerity and funding cuts to public education, school districts may be using portable classrooms in lieu of new school construction.

As many students across Canada and the United States continue to receive education in these structures, the question about the possible relationships between portable classroom use, school socioeconomic factors, and student achievement has become urgent and necessary. A better understanding of the socioeconomic factors associated to portable classroom use, as well as recognizing the implications of portable classrooms for student learning, could provide important insights for policy making, education planning, and instructional practice. This study explored a data set that included school-level data on enrolment, classroom counts, achievement, and demographics from the 27 largest school districts (with approximately 2.700 schools) in the province of Ontario, Canada. The following questions guided the research:

Q1: What is the relation between socioeconomic status and portable classroom use?

Q2: What is the relation between portable classroom use and academic achievement?

Research on the relations between learning spaces and student outcomes has consistently demonstrated that the physical condition and layout of the school influence student achievement and well-being (Blackmore et al., 2011; Byers et al., 2018). Furthermore, new approaches to teaching and learning in the 21st century have stressed the importance of spaces in education, which has prompted researchers to consider the structure, organization, and conditions of the learning environment (Cleveland & Fisher, 2014). While these relationships have been investigated in relation to permanent brick-and-mortar environments, one aspect of educational provision that has received little attention is the use of temporary or portable structures to accommodate students in schools (Chan, 2009). Demographic changes due to urbanization, residential mobility, and various forms of migration have shifted the composition of school populations in many jurisdictions.

As school systems strive to respond to these challenges, available spaces have become insufficient to provide equitable educational opportunities for all students. This situation has forced many school boards to adopt temporary forms of student accommodation, such as portable classrooms, while permanent facilities are built. Developing an academic and empirically informed understanding of the contexts and outcomes associated with these environments is crucial, given the pervasiveness of temporary accommodations in many educational jurisdictions and the tendency of these structures to remain in place for long periods (Riveros, 2023). This study aims to reinvigorate conversations about two crucial yet neglected areas in the education policy literature, namely, school planning and education infrastructure. By adopting a critical spatial perspective to the study of educational facilities, this research aims to provide new insights into public education policy, politics, and administration.

Educational Spaces, Policy, and the Mediation of Social Relations

A notable body of scholarship in social theory has argued that social relations are inherently spatial (Robertson, 2010). These critical theorizations of space contend that there is a mutually constitutive relation between social processes and spatial processes, which presupposes a relational understanding of social reality. In this context, "relational" means that social actors, objects, and processes exist only in relation to other social actors, objects, and processes. Perhaps one of the most important notions to consider when adopting a spatial perspective to the analysis of social phenomena is "relationality." If we assume that social reality is constituted relationally, it follows that an exploration of social processes and actors should consider how identity is a product of multiple intersections. For example, a relational understanding of what constitutes a "student," a "teacher," or a "principal" requires an examination of the position of these social actors in relation to other actors and processes. It is only in reference to those relations that someone is conferred a social identity.

According to the relational perspective, space is produced socially, and society is produced through

space. This could be evidenced in social history: processes of social production and reproduction have created racialized spaces, gendered spaces, and (dis)abled spaces, where groups and individuals are sorted and segregated (Robertson, 2010). Space, in this sense, is an essential component in historical processes of socioeconomic differentiation. Since these processes are shaped and facilitated through space, it is incumbent on social researchers to investigate these spatial dynamics and to provide new forms of understanding that could inform social change.

As a social space, the school exists as a product of the many social, political, and material relations that shape its operation and effects. There is nothing intrinsic to a building for it to be considered a school, as evidenced by the many versions or types of schools that can be found around the world. What makes a particular building a "school" is the position that it occupies in a network of social, political, and material relations. The location of the school, which is often a matter of policy, could exacerbate racial, economic, and residential segregation or promote the integration of separated communities (Richards, 2014). Similarly, a school could stimulate economic prosperity by supporting the conditions for residential growth, but it could also be coopted by elites to perpetuate their social advantage (Tieken & Auldridge-Reveles, 2019). All these processes are spatially contingent and, as such, require the deployment of spatial vocabularies and sensitivities.

By adopting a socio-spatial perspective, education policy analysts would be able to recognize how space is implicated in the circulation of power and the production of diverse social arrangements, including hierarchies, exclusions, inclusions, privileges, and oppressions. (Riveros & Nyereyemhuka, 2023). Policies, in this sense, are productive; they are implicated in the creation of social realities. Socio-spatial approaches to policy analysis have the potential to reveal the material contradictions that underlie social change. As noted above, processes of racial and socioeconomic segregation and their subsequent effects on schooling are examples of the spatial consequences of public policies (Richards, 2014). Similarly, austerity-driven policies that reduce funding for school construction or expansion have the consequence of producing overcrowding and thus, schools with high dependence on portable classrooms. As noted by Gulson and Symes (2007), "the adoption of a neo-liberalist policy agenda has brought into focus the differentiating spatial effects of unequal provision" (p. 105). Through policies that promote austerity, school boards are put in a position where they are dependent on portable classrooms to address overcrowding. Under these circumstances, portable structures have become a necessary and permanent component of schools, which may result in suboptimal learning spaces where the educational experience may be compromised.

There are different types of portable classrooms in the market, and it could be argued that factors like quality of construction, longevity, available amenities, and distance to the main building could make a difference in the student's experience. Yet, an emerging body of literature on portable classrooms (Riveros, 2023) has provided evidence of the potential implications for health, well-being, and learning for students in these facilities, particularly when these structures are used beyond their life expectancy (Filardo, 2016). Some concerns include poor air quality, improper ventilation, thermal discomfort, noise, moisture, inadequate lighting, and lack of maintenance (Branham, 2004; Drury, 2014). For instance, Shendell et al. (2004) found that the rates of absenteeism are higher in portable classrooms than in regular classrooms, and these findings were confirmed by Branham (2004) and Jenkins (2004). In addition to these important concerns, there is the question of creating welcoming and inviting educational facilities. Should it be acceptable that some students learn in permanent buildings, with access to amenities and more comfort, while others learn in provisional, prefabricated, and often isolated structures? Should we excuse the inaction and lack of planning of those in charge of ensuring an equitable and high-quality education experience for all children?

Funding cuts to public education are not new. Studies on public education funding in Australia (Reid, 2020), the United Kingdom (Belfield et al., 2018), the United States (Jackson et al., 2021; Sosina & Weathers, 2019), and many other jurisdictions have reported significant reductions in budgets for school operation, maintenance, and construction. In the case of Ontario, it was reported that by 2019, the school repair backlog accumulated a deficit of $16.3 billion in Canadian dollars (Rushowy, 2019). In addition to this shortfall, Tranjan et al., (2022) noted that per-pupil funding decreased between the years 2017 and 2022. According to the Financial Accountability Office of Ontario (2021), recent provincial education budgets have not kept up with inflation, which will create a funding gap of $2.9 billion in Canadian dollars by

the year 2023–2024. Mackenzie (2017), in his analysis of the funding mechanisms of public education in Ontario, noted that the projected levels of funding are insufficient to address the backlog. He suggested that the funding formula needs to be changed from headcount-based funding to a more holistic approach that considers the role of the school in the community and the differences and challenges that result from the school's geographical location.

Unfortunately, the question of funding for education infrastructure has been less prominent in conversations about education policy. This paucity has probably been driven by a simplistic understanding of school facilities as mere physical spaces and the realm of bureaucrats. This simplification prevents a more informed and critical discussion about the implications of built social spaces for equity, learning, and well-being.

Context of the Study

Aiming to answer the research questions regarding the relations between portable classroom use, socioeconomic status, and achievement, we focused on public schools in the province of Ontario in Canada. With most people living in urban centres, Ontario is the most populous province in the country. There are four types of publicly funded schools in the province: English secular, English Catholic, French Catholic, and French secular. Due to a long-standing constitutional provision, Catholic schools are publicly funded in Ontario and, for all intents and purposes, are considered part of the public school system (Education Act, 1990). In 2022, there were 3,960 elementary and 872 secondary schools serving 2,028,685 students in Ontario (Ministry of Education, 2023).

This study focused on the English secular and English Catholic school boards in the largest urban centres with a population of 100,000 or more. Table 1 lists the 27 school boards (13 English Catholic and 14 English secular) included in the study. We did not include French Catholic and secular school boards in the sample because two of the variables included in the models related to English language use, namely, "percentage of students whose first language is not English" and "percentage of students new to Canada from a non-English speaking country". Thus, the inclusion of French school boards would have added an element of heterogeneity that may have muddled the interpretation of the findings.

Table 1
Location, Name, and Type of School Boards Sampled

Location of the School Board	Name of the School Board	Type
Barrie	Simcoe Muskoka Catholic DSB	Catholic
	Simcoe County DSB	Public
Burlington, Milton, and Oakville	Halton Catholic DSB	Catholic
	Halton DSB	Public
Guelph	Wellington Catholic DSB	Catholic
	Upper Grand DSB	Public
Hamilton	Hamilton-Wentworth Catholic DSB	Catholic
	Hamilton-Wentworth DSB	Public
Kingston	Algonquin and Lakeshore Catholic DSB	Catholic
	Limestone District School Board	Public
London	London District Catholic School Board	Catholic
	Thames Valley DSB	Public
Mississauga-Brampton	Dufferin-Peel Catholic DSB	Catholic
	Peel DSB	Public
North York	York Region DSB	Public

Location of the School Board	Name of the School Board	Type
Niagara and St. Catharines	Niagara Catholic DSB	Catholic
	District School Board of Niagara	Public
Oshawa	Durham Catholic DSB	Catholic
	Durham DSB	Public
Ottawa and Kanata	Ottawa Catholic School Board	Catholic
	Ottawa-Carleton DSB	Public
Toronto	Toronto Catholic DSB	Catholic
	Toronto DSB	Public
Waterloo and Kitchener	Waterloo Catholic DSB	Catholic
	Waterloo Region DSB	Public
Windsor	Windsor-Essex Catholic DSB	Catholic
Windsor and Essex	Greater Essex County DSB	Public

Notes.
DSB = District School Board.
"Location" refers to municipalities in Ontario with a population of 100.000 or more (Statistics Canada, 2022, September 9)

This study offers an initial exploration of the use of portable classrooms in Ontario. We were interested in the overall state of the portable classroom situation in the province; therefore, we did not make distinctions between Catholic and secular schools in the analysis. While it is possible that contextual differences between Catholic and public schools may influence portable classroom use, we believe that such investigation requires a separate study. The findings reported in this research offer an initial approach to the issue, aiming to highlight possible areas for further exploration and analysis. Finally, while the large English school boards included in the sample are predominantly urban, it should be noted some may serve a few rural or less densely populated areas. We did not control for these differences in our models as we wanted to obtain a general picture of the ways in which enrolment pressures impact large boards. We recognize that additional nuance could be introduced in future studies that examine issues of enrolment in rural schools.

Sample and Methods

This study used a data set created by merging three sources of administrative data comprising the years 2017–2018, 2018–2019, and 2019–2020. The data came from the 27 largest school boards in Ontario, Canada, with approximately 2.700 schools. These schools serve an average of 1.3 million students, which represents 63% of the student population and 55% of the total schools in the province. To create the data set, we merged enrolment, achievement, demographics, and portable classroom count data. First, we collected enrolment data for all schools in the sampled school boards. The data included average daily enrolment and utilization rate at the school level. The average daily enrolment was obtained by averaging the number of students enrolled in the school at the beginning and at the end of the school year, while the utilization rate was obtained by dividing the number of enrolled students by the number of instructional spaces in the school. Table 2 summarizes the enrolment data, number of schools, and portable classroom counts included in the sample.

Table 2
Descriptive summary of the enrolment, schools, and portable classroom data included in the sample.

	Average (Total sample)	Change	
		#	%
Enrolment	1,356,390.5	30,959.0	2.3
Schools	2,761.3	20.0	0.7
Portables	5,322.7	316.0	6.1

Second, we gathered achievement data reported by the Education Quality and Accountability Office of Ontario. The achievement data included the percentage of students who met the provincial standard on math, reading, and writing for Grades 3 and 6, as well as the percentage of students who met the provincial standard on math and applied math for Grade 9. Also, we included the percentage of students who passed the Grade 10 Ontario Secondary School Literacy Test (OSSLT) on their first try. As part of the achievement data set, the Ministry of Education included the following demographic information, expressed as percentages, at the school level: students whose first language is not English; students new to Canada from a non-English-speaking country; students receiving special education services; students identified as gifted; students who live in low-income households; and students whose parents have no degree, diploma, or certificate.

Third, we collected school-level portable classroom counts from each of the school boards in the sample and merged this data with the enrolment, achievement, and demographic data. A small percentage of demographic data was missing from the original data set, which was 0.63% of the total demographic observations. Missing demographic data were imputed using the multiple imputation by chained equations model (Wulff et al., 2017). No imputation was conducted on enrolment, achievement, or portable classroom count data. Table 3 provides an overview of the variables included in the final data set.

Table 3
Variables used in the data set

Variable	Mean	*SD*
Enrolment		
Utilization rate [a] (%)	93.2	0.3
Average daily enrolment [b]	491.2	306.6
Portable classroom counts	1.9	3.1
Demographic		
% of students whose first language is not English	27.2	22.7
% of students new to Canada from a non-English-speaking country	6.8	7.9
% of students receiving special education services	15.8	11.0
% of students identified as gifted	1.2	4.3
% of school-aged children who live in low-income households	19.1	11.3
% of students whose parents have no degree, diploma, or certificate	6.2	6.6
Achievement		
% of Grade 3 students meeting provincial standard in reading	74.4	14.5
% of Grade 3 students meeting provincial standard in writing	70.4	17.0
% of Grade 3 students meeting provincial standard in math	59.2	17.5
% of Grade 6 students meeting provincial standard in reading	81.0	12.6
% of Grade 6 students meeting provincial standard in writing	81.1	13.2
% of Grade 6 students meeting provincial standard in math	48.6	19.3

Variable	Mean	*SD*
Achievement		
% of Grade 9 students meeting provincial standard in math	78.6	17.5
% of Grade 9 students meeting provincial standard in applied math	42.4	17.5
% of Grade 10 students who passed the OSSLT in one try	76.5	17.8

Note. OSSLT = Ontario Secondary School Literacy Test.
[a] Number of enrolled students divided by the number of instructional spaces in the school.
[b] Average number of students enrolled at the beginning and at the end of the school year.

Several education policy researchers have investigated the implications of standardized testing for marginalized students (Cheng & Sun, 2015; Rezai-Rashti & Lingard, 2021). These studies have revealed that the implementation of testing regimes may contribute to exacerbating current inequalities in the school system. Moreover, when used in a punitive way, such as in the creation of school rankings, or when linked to teacher performance, standardized testing becomes just another tool in the marketization of public education. While we recognize these limitations, we used standardized test scores to introduce a partial, yet relevant, indication of student learning at the school level, which was essential to our analysis.

Analytical Strategies

The answer to each research question required the adoption of separate analytical strategies. Q1 (What is the relation between socioeconomic status and portable classroom use?) required us to test the probability that a school would have a high or low number of portable classrooms based on its demographic characteristics. This means that the dependent variable, that is, the variable affected by the demographic variables, would be the portable classroom counts. Since we wanted to determine the probability of having a high number of portable classrooms, we employed a binomial logistic regression model.

Analytical Strategy for Question One

The binomial logistic regression model is a statistical model used to predict the probability that a given observation would fall into one of two categories corresponding to a dependent variable. In this case, the dependent variable, namely, the number of portable classrooms, was split into two categories: low portable classroom count (0–4 portables) and high portable classroom count (≥5 portables). We used the Jenks natural breaks optimization method to create the two groups corresponding to the binary response variable. The Jenks natural breaks method uses an algorithm to identify inherent grouping trends in the data (De Smith et al., 2018). The algorithm works by grouping similar values together, which maximizes the average differences between classes. Depending on the desired number of groups (two in our case), the algorithm minimizes the variation within each group by grouping values that are close to each other. The algorithm revealed that if we want to break the entire data set (portable classroom counts by school) into two groups, the mean values for 0, 1, 2, 3, and 4 would be closer to each other than the rest of the mean values in the data set.

The independent variables included the following demographic information, expressed as percentages, at the school level: students whose first language is not English, students identified as gifted, students who live in low-income households, students whose parents have no degree diploma or certificate, students receiving special education services, and students new to Canada from non-English speaking countries. In addition to the demographic variables, we included the utilization rate in the data set, which allowed us to test the intuition that the odds of having a high number of portable classrooms would increase by having high utilization rates. Each model lists the most significant variables selected through a stepwise selection process (Harrell, 2015).

A key output of the logistic regression model is the log odds ratio. In the output of the logistic regression, the coefficient (β) indicates the expected change in the log-odds when the independent variable x changes by one unit. The standard way to interpret the log-odds is to change the "log-odds" to "odds." This can be accomplished by exponentiating the log-odds ($\exp^{\beta}$), which will show how the change in one

unit in the independent variable multiplies the odds of obtaining the expected outcome in the dependent variable. For example, in the elementary model, the odds-ratio for "% of students whose first language is not English" is 0.019, which is a significant result at the <0.001 level. By exponentiating the "log-odds" we obtain the "odds" (exp. (0.019)) = 1.02, which can be interpreted as: everything else equal, increasing the percentage of students whose first language is not English by one unit (1%) would multiply the odds of having 5 or more portable classrooms by 1.02.

Analytical Strategy for Question Two

To answer Q2 (What is the relation between portable classroom use and academic achievement?), we applied independent multivariate ordinary least-squares (OLS) models to each one of the achievement variables. Each achievement variable was treated as an independent variable. We estimated the association with the demographic variables and the classroom counts by school and, aiming to add more nuance to the analysis, controlled for the number of portable classrooms by creating four dummy variables. Similar to the procedure used for Q1, we employed the Jenks natural breaks optimization method to identify optimal breaks in the dataset and assigned each grouping to a dummy variable. In this case, we used schools with no portable classrooms as reference, that is, as the base group to contrast the results of the dummy variables. We found that grouping the schools by number of portable classrooms (i.e., 1–4 portables, 5–9 portables, and 10–26 portables), and adding the base group (0 portables), revealed significant trends. It should be noted that the range of the portable classroom data was 1-26; that is, the schools that had the lowest number of portable classrooms had 1, and the schools that had the highest number of portable classrooms had 26. When grouped into smaller sets (e.g., five or six groups), the results were not significant. This was probably because the data became too granulated to provide useful insights.

As noted above, the analysis was performed at the school level. The regression models were run for each of the achievement variables to explore how demographic variables and portable classroom counts influence students' academic achievement in different subjects. OLS regression models are used to predict the output of the dependent variable in terms of its relationship to a set of explanatory variables. The equation for OLS is given below:

$$Y = \beta 0 + \Sigma j=1...n\ \beta jXj + \varepsilon$$

where Y is the dependent variable, β0, is the intercept of the model, Xj corresponds to the jth explanatory variable of the model (j = 1 to n), and ε is the random error with expectation 0 and variance σ^2 (Hayashi, 2000). In this case, achievement was the dependent variable (Y). Demographic, portable classroom counts, and utilization rate were the independent variables (Xi).

Results and Discussion

Socioeconomic Variables and Portable Classroom Use

Table 4 shows the results for the three regression models that examined this relationship. We created three models: one for elementary, one for secondary, and one that combined both panels by averaging variables. The log odds-ratio for each model is listed in the columns beside each independent variable. For all models, it should be noted that high utilization rates increased the odds of receiving a high number of portable classrooms. While this finding may appear obvious, it is important because it confirms our initial assumption that school boards are addressing accommodation issues with portable classrooms.

Table 4
Binomial Logistic Regression

Variables	Model		
	Elementary	Secondary	Elementary and secondary combined
Intercept	-5.950*** (0.234)	-4.771*** (3.596)	-6.095*** (0.200)
% of students whose first language is not English	0.019*** (0.002)	0.010* (0.004)	0.021*** (0.002)
% students identified as gifted	-0.020* (0.009)	-0.314† (0.187)	
% of school-aged children who live in low-income households	-0.014** (0.005)	-0.066*** (0.144)	-0.034*** (0.004)
% of students whose parents have no degree, diploma, or certificate	-0.032*** (0.009)		
% of students receiving special education services	-0.030*** (0.008)		0.010* (0.004)
% of students new to Canada from a non-English-speaking country		0.042*** (0.012)	
School utilization rate	4.214*** (0.167)	4.528*** (0.349)	4.180*** (0.148)

†p <0.1; *p <0.05; **p <0.01; ***p <0.001 (Standard Error)

English Language Learners and Portable Classroom Use

An increase in the percentage of students whose first language is not English seemed to increase the odds of receiving a high number of portable classrooms for all models. For the model that groups both panels, the coefficient suggests that everything else equal, one unit increase in the percentage of students for whose English is not their first language multiplied the odds of having a high number of portable classrooms (≥5) by 1.02. There is another significant language-related variable: new to Canada from a non-English speaking country. In this case, and holding everything else equal, the odds of having a high number of portable classrooms increased by a multiplicative factor of 1.04 when the mean percentage of students new to Canada from a non-English speaking county increased by one point ((exp (0.042) = 1.04).

The finding that the odds of a high number of portable classrooms increased as the numbers of students new to the country increased suggests that immigrant students are more likely to attend overcrowded schools. The very limited body on research on portable classrooms (Riveros, 2023; Branham, 2004; Chan, 2009) has not explored in much detail the socioeconomic characteristics of the schools that use these structures. The association between immigration status and school overcapacity suggests a lack of coordination between school boards, municipalities, provincial, and federal governments in relation to providing educational opportunities for newcomers. Statistics Canada (2022) has frequently noted that immigrants prefer to make their residence in large urban centres, which suggests that schools in neighborhoods that receive immigrants are more likely to become overcrowded. The link between portable classrooms and immigration demands a more proactive approach to address accommodation issues in schools that receive high numbers of immigrant students.

It should be noted, however, that the immigration status variable alone did not provide any information about the racial or ethnic background of the students. We were cautious to avoid any inference about race from the linguistic background or immigration status of the students. Unfortunately, the data that we used for the analysis did not include variables directly associated with race or ethnicity. Based

on the data that was available to us, it would be inappropriate to make inferences in this regard. Future studies could link census data to this data set to obtain a more detailed understanding of the racial characteristics of the students in the schools that use portable classrooms.

Special Education

The other significant variable in the combined panel model was the percentage of students who receive special education services. That is, overall and holding everything else equal, the odds of having five or more portable classrooms increased as the number of students in special education increased. It should be noted, however, that while this variable was also significant in the elementary model, the coefficient was negative. This suggests that in the elementary panel alone, the odds of receiving a high number of portable classrooms decreased as the number of special education students increased. We believe that the discrepancies between the combined and elementary models are related to the differences in size and composition between elementary and secondary panels. Compared to secondary schools, elementary schools, which made up a larger portion of the sample, tend to have lower enrolments and fewer students receiving special education services per school (People for Education, 2018). This could explain the negative relationship. In contrast, with fewer schools and a larger concentration of students receiving special education services per school, secondary schools would have increased odds of having many portable classrooms on site, which was captured by the positive signal in the combined panel coefficient.

These discrepancies invite a closer examination of the relationships between receiving special education services and portable classroom use in each panel. Perhaps a case study approach, with a qualitative component, could reveal differences and similarities between special education supports and services in the elementary and secondary schools that use portable classrooms.

Gifted Education

The variable for the percentage of students identified as gifted was significant in the elementary and secondary models but not in the combined model. The coefficient has a negative sign, which suggests that everything else equal, an average increase in gifted students decreased the odds of having five or more portable classrooms on site. This finding suggests that schools with gifted programs tend to have fewer portable classrooms on site. From the data alone, it is not immediately clear why these schools tend to have a lower number of portable classrooms. It could be hypothesized, however, that enrolment in these schools is exclusive and determined by the nature of the specialized programs. In these cases, enrolment is program-dependent, so the number of students would not increase unless the specialized program expands. The restrictions imposed by selective enrolment policies reduce the need for additional accommodation and, therefore, could reduce the need for portable classrooms.

Research into the relations between socioeconomic status and access to gifted education has shown that higher-income students are overrepresented in these programs (Grissom et al., 2019). It has been argued that high-income families have the social and economic capital to maneuver the politics of school boards, which allows them to mobilize against changes in the composition of the school. For instance, Butler et al. (2019) demonstrated how elite families in Ottawa used their social advantage to preserve the exclusive status of a school that housed gifted programs. Through political influence, high-income families maintained the status quo and restricted the expansion of regular track offerings.

Income Levels and Portable Classroom Use

While the variable "percentage of students who live in low-income households" was significant in all models, the relationship was negative, as evidenced by the negative sign that accompanies the coefficient. A negative relationship suggests that, everything else equal, the odds of receiving a high number of portable classrooms increased as the percentage of low-income students decreased. This finding suggests that schools with high levels of low-income students have fewer odds of having a high number of portable classrooms. This finding will be fleshed out further once we compare these results with the achievement models. We believe, however, that the negative relationship between income and portable classroom use reveals an additional phenomenon in relation to enrolment.

The variable for utilization rate was positively associated with the portable classrooms variable in all models, suggesting that the odds of having a high number of portable classrooms increased as

overcrowding increased. When contrasted with the negative coefficient for the low-income variable, this finding suggests that schools that serve low-income students could be experiencing a decline in utilization rates. Since low utilization rates could decrease the odds of more than 5 portable classrooms, and since low odds of more than 5 portable classrooms could signal an increase in low-income students, then an increase in low-income students could signal a decline in utilization rate. This is an important finding because a decline in utilization rate puts low-income schools at risk of closure. Low utilization rates are one of the criteria adopted by the Ontario Ministry of Education (2018) to determine the closure of a school.

The literature on school closures has highlighted the devastating consequences that closing a school has for low-income and racialized communities (Tieken & Auldridge-Reveles, 2019). The reasons for enrolment decline are diverse. Processes of population decline and changes in the neighbourhood nature and composition could be triggered by urban sprawl, gentrification, and economic decline in certain areas. Middle- and high-income families have greater capacity to change their residential location, which exacerbates the decline.

Achievement and Portable Classroom Use

A pattern emerged when we examined the results of the achievement and portable classroom count models. Tables 5 and 6 show the results for the classroom count variables (dummies). We decided not to include the results for the demographic variables in these tables since they were not the focus of Q2. In elementary schools, low levels of portable classroom use (1–4 portables) were positively associated with some measures of achievement (i.e., Grade 3 math, reading, writing and the combined school averages for Grades 3 and 6 math, reading, and writing). It should be noted, however, that there is a well-documented positive association between income and achievement; that is, all else being equal, an average increase in family income is associated with an average increase in student achievement at the school level (Reardon et al., 2019).

We suggest that this association could explain why, in the logit regression, schools with an increase in low-income students had lower odds of having a high number of portable classrooms. Since income seems to be positively associated with achievement, and achievement seems to be positively associated with portable classroom use, it could be concluded that income would be positively associated with portable classroom use. In other words, even though higher-income schools tend to receive a moderate number of portables (1–4), the achievement in these schools is not affected because achievement is strongly mediated by income. That is, income still drives achievement despite the existence of a moderate number of portable classrooms.

Table 5
Results of Multivariate Regressions for Grades 3 and 6

Number of portable classrooms	Grade 3				Grade 6				Grades 3 and 6			
	Math	Reading	Writing	Average	Math	Reading	Writing	Average	Math average	Reading average	Writing average	Overall average
1–4	0.014**	0.011**	0.014***	0.013***	-0.003	0.004	0.005	0.002	0.007†	0.009**	0.010**	0.009**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
5–9	0.013*	0.003	0.008	0.008	0.013†	0.001	0.007	0.007	0.011†	0.000	0.004	0.005
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
10–26	-0.022†	-0.015	-0.019	-0.018†	-0.043**	-0.007	-0.002	-0.017†	-0.037**	-0.012	-0.014	-0.021*
	(0.013)	(0.011)	(0.013)	(0.011)	(0.014)	(0.009)	(0.009)	(0.009)	(0.012)	(0.008)	(0.010)	(0.009)
R^2 (%)	27	24	19	27	29	34	32	37	35	36	32	38

†p <0.1; *p <0.05; **p <0.01; ***p <0.001 (Standard Error)

Table 6
Results of Multivariate Regressions for Grades 9 and 10

Number of portable classrooms	Grade 9			Grade 10	Grades 9 and 10
	Applied math	Math	Average	OSSLT first try	Average
1–4	0.014	-0.001	0.006	0.003	0.005
	(0.012)	(0.009)	(0.009)	(0.006)	(0.007)
5–9	0.004	0.009	0.006	0.005	0.006
	(0.013)	(0.010)	(0.010)	(0.007)	(0.008)
10–26	-0.019	-0.030*	-0.024*	-0.015†	-0.021**
	(0.016)	(0.012)	(0.012)	(0.009)	(0.009)
R^2 (%)	30	57	48	80	66

Note. OSSLT = Ontario Secondary School Literacy Test.

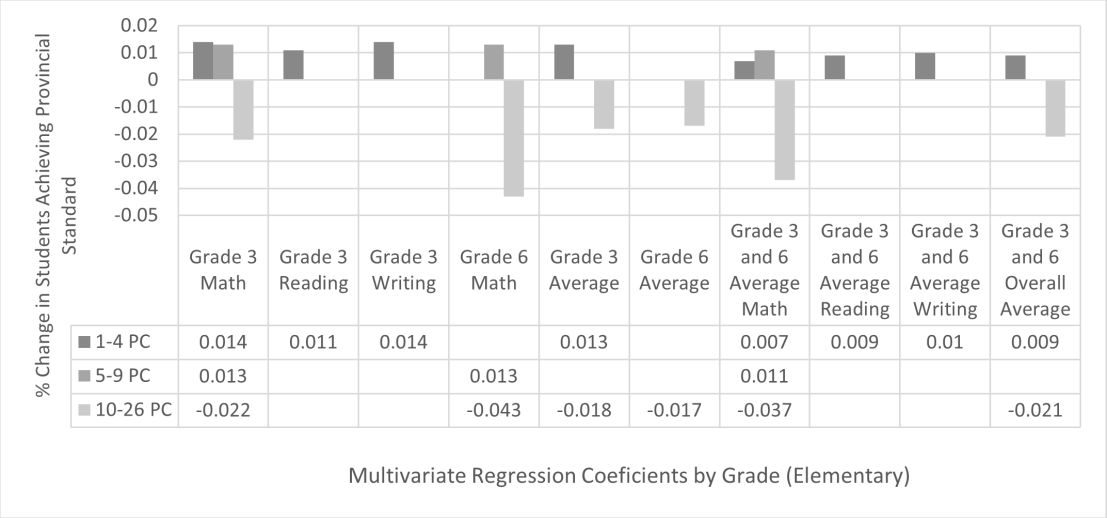
†p <0.1; *p <0.05; **p <0.01; ***p <0.001 (Standard Error)

One possible explanation for this relationship is that growing and developing neighbourhoods could attract middle-class and affluent families, causing enrolment demand in local schools and thus generating the demand for portable classrooms. Less wealthy families, who have less mobility, would have no other option than to remain in the declining neighbourhoods where school enrolments also decline, therefore avoiding the need to use portable classrooms. Based on the association between income and achievement, it could be inferred that schools with declining enrolment, and a higher number of low-income students, would be more likely to observe a decline in overall achievement.

A result that may add nuance to the trend discussed above could be observed when controlling for intensive use of portable classrooms (≥10 portables). In this case, despite the influence of income, achievement seemed to decline when schools had more than 10 portable classrooms on site. While moderate use of portable classrooms (1–4 portables) did not seem to negatively affect achievement, intensive use (≥10 portables) seemed to have some significant effects. Tables 5 and 6 show the results of the multiple linear regression models for achievement when portable classrooms were equal or more than 10. For the secondary panel, the coefficients for students who passed the OSSLT on their first try, Grade 9 math and average, and Grade 9 and 10 average were significant and negative. That is, everything else equal, for secondary schools that had 10 portable classrooms or more, there was an average decline in each of the academic measures mentioned above. The elementary model had similar results, where significant and negative associations could be seen between test scores and intensive use of portable classrooms (≥10). For the elementary panel, the significant variables were Grade 3 math and average, Grade 6 average, Grades 3 and 6 math average, and Grades 3 and 6 overall average. Figure 1 illustrates the association between achievement differences and the number of portable classrooms in the elementary panel.

Figure 1

Elementary Achievement and Number of Portable Classrooms



Note. PC = portable classrooms.

Various explanations can be offered for these results. First, portable classrooms are a symptom of overcrowding, but they are not a solution to overcrowding. The portable classroom addresses the imme-

diate concern for instructional spaces, but the congestion in other areas of the building remains unaddressed. Despite the introduction of portable classrooms to accommodate classroom instruction, other facilities in the school (e.g., school gym, laboratory, specialized rooms for music and arts, library, and bathrooms) continue to be overutilized. This could create scheduling conflicts, limited use, and lack of comfort. Behavioural issues could be more prevalent in crowded areas, and the continuous displacement between buildings could create distractions and loss of instructional time. Second, it has been reported that air quality, temperature, and noise can affect health and well-being (Ready et al., 2004). Schools with temporary structures tend to have higher rates of absenteeism, which could be related to the impact that these facilities have on the school's environmental conditions (Branham, 2004).

Closing Reflections: Implications for Policy and Practice

Several implications for policy and practice can be drawn from the findings outlined above. First, the strong association between utilization rates and portable classroom use is an indication that school boards are addressing enrolment pressures with these structures. In a related study, Riveros (2023) revealed that the school boards in the largest urban centres in Ontario (population >100,000) had an average of 5,200 portable classrooms per year between 2010 and 2020. This figure alone offers an indication of the significant backlog in school infrastructure in the province and suggests that portable classrooms are far from a temporary solution to overcrowding. The strong association between utilization rates and portable classrooms reported in this study confirms these findings.

More funding for school construction and expansion is part of the solution to reduce the school boards' dependence on portable classrooms. In the context of Ontario, however, a change in the levels of capital funding requires a change in the funding formula, which is a set of criteria used by the Ministry of Education to fund the operation of public school boards in the province. Despite numerous calls for changing the funding formula (Mackenzie, 2017) to incorporate contextual factors and to recognize local needs, the criteria remain focused on student headcounts. Furthermore, the allocation of funding for new schools requires that school boards demonstrate current need and not projected need, which means that schools must be already overcrowded for the board to receive construction funds. This is especially dramatic in schools located in growing neighborhoods where the need tends to increase year after year as the neighborhood keeps growing. Hence, a school built in 2022 with accommodation needs from 2020 will be already overcrowded, and filled with portable classrooms, by the time it is opened (Newcombe, 2022). Funding cuts to public education are not new, and this study reveals yet another aspect of their negative effects. Austerity policies create schools that are less welcoming, impacting the educational experience of students. As noted by Blackmore et al. (2011), the condition of education facilities has the potential to impact the perception of public education, which may nudge parents and policy makers to support alternatives to the public system.

Overcrowding and high dependence on portable classrooms reveals a less visible link between urban planning and school planning. When school boards are forced to play "catch up" to municipal planning, student accommodation becomes a more difficult and less predictable task. Urban sprawl, gentrification, and other processes of urban change have a serious impact on the operation of school boards, forcing them to stretch out resources that otherwise could be concentrated in fewer areas. While the independence between school boards and municipalities in Ontario (Sancton, 2021) has the benefit of making school boards less vulnerable to local politics, the absence of a formal mechanism for school boards to have a say in urban growth makes school planning an afterthought to municipal planning.
Perhaps better coordination between school boards and municipalities and enhanced participation in land-use decisions could improve school planning. It should be noted that in Ontario, most school boards are authorized to collect "education development charges" (Education Act, O. Reg. 20/98, 2022) from land developers. These funds can be used to purchase land for school construction. The size of the new school, however, is approved by the Ministry of Education based on the school board's request. As noted above, the approval of funds for new school construction is contingent on current needs and not projected needs, which tends to delay or exacerbate the overcrowding situation.

Second, this study revealed connections between the percentage of English language learners, students new to Canada from non-English-speaking countries, and portable classroom use. The implication here is that overcrowding may be localized in areas with large numbers of immigrant families, which suggests that current supports to accommodate this population could be insufficient, at least in terms of

the quality and quantity of the educational facilities that serve them.

Third, by suggesting a positive association between income and portable classroom use, this study calls for additional research on the possible decline in enrolment in low-income schools. While it might be noteworthy to find that students in low-income households have fewer odds of using portable classrooms, an implication of this finding is that the schools that serve this population could be at risk of closure. Since there is overwhelming evidence of the devastating consequences of school closures for low-income and racialized communities (Tieken & Auldridge-Reveles, 2019), this implication invites further examination and proactive policy action to resist and counter possible closures.

Fourth, the observed decline in the measures of student achievement for schools that had intensive use of portable classsrooms (≥10) should be a warning sign for policy makers and administrators. The cynical view could suggest that the declines noted in Table 4 are not dramatic, yet we question if decline is what we want in our schools. This finding highlights the relevance of the spatial configuration of the school for learning and brings into light the type of inequitable outcomes that are produced through spatial differentiation. Also, this finding confirms the results from previous studies, according to which the condition of educational facilities plays an important role in students' learning experience and academic performance. Future studies could investigate the qualitative aspects of this association by exploring teachers' and students' experiences in portable classrooms.

The continued dependence on portable classrooms in many school boards in Ontario (Riveros, 2023) and other jurisdictions could be a sign of societal changes, such as higher residential mobility and other demographic shifts. Perhaps it is time to reconsider the nature, purpose, and configuration of educational facilities. The high dependence on portable classrooms could be an indication that policy makers, planners, and administrators need to take the challenges of portability and modularity seriously. That is, to advocate for more malleable and adaptable school spaces, with clear pedagogical intentionality, that can be responsive to these fluctuating enrolment patterns.

Limitations and Future Directions

This study was limited by the data available to us. First, the timeframe of the data set (i.e., 2017–2018, 2018–2019, 2019–2020) was relatively short. While this could be perceived as a disadvantage, the promising results presented here invite the construction and examination of larger data sets. Second, since we worked with a limited number of socio-demographic variables, we were unable to make inferences about other important factors and relations such as gender, race, ethnicity, indigeneity, and language spoken at home. Third, we were unable to collect classroom-level data; that is, our data set did not tell us which grades went to which classrooms. We were surprised to find that most school boards do not maintain a systematic record of the specific grades that use portable classrooms. The structure of our data allowed us to investigate between-school variations and not in-school variations. Fourth, this study focused on large school boards that serve large urban centres. We did not consider rural school boards in the analysis. It is possible that some of the school boards included in this study had several rural schools, but we did not control for this factor as we wanted to maintain a general focus on the phenomenon of portable classrooms in large school boards. In addition, we recognize that enrolment is also an issue for schools in rural areas. Future studies could examine the use of portable classrooms in these schools.

Finally, and based on this study's findings, we cannot make claims about the experiences of students and teachers who use portable classrooms. Subsequent studies could examine the qualitative aspects of the findings outlined here. It would be useful to expand this investigation to other Canadian provinces to identify trends, practices, and outcomes regarding the use of portable classrooms.

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