

# School success and social deprivation map on the Island of Montreal



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For the past fifty years, the Comité de gestion de la taxe scolaire de l'île de Montréal (Comité de gestion) has been supporting school service centers and school boards on the Island of Montréal within the context of education in underprivileged areas.

> To fulfill this mission, the Comité de gestion has developed a tool for understanding Montreal's urban fabric: the School success and social deprivation map on the Island of Montreal (the Map). This tool enables the Comité de gestion to:

- identify the location of underprivileged areas with lower school success rates
- distribute monetary allocations in the most vulnerable areas

Map 2023 is the **tenth map** produced by the Comité de gestion. The first was published in 1975. The Map and its guide are available to school service centres and school boards on the Island of Montreal and to the public.

# Acknowledgements

Map 2023.

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### The Comité de gestion would like to take this opportunity to thank those who contributed to

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# Introduction

One mandate of the Comité de gestion is to distribute, among the school service centres and school boards on the Island of Montréal, funds from school taxes collected and the investment income earned to implement educational catch-up measures in underprivileged areas on the Island of Montréal.

To carry out this responsibility, the Comité de gestion produces and uses a tool for understanding Montreal's urban fabric, the School success and social deprivation map on the Island of Montreal. This tool comprises two essential elements: the base map and the Global School Success Index.

# What's new

This year, the Comité de gestion was faced with a major challenge. After many years of production, it was necessary to question the relevance of the variables and weightings used in previous versions of the map to define and calculate the Global School Success Index (GSSI).

In the fall of 2022, the Comité de gestion retained the services of the Centre of Excellence for Statistical Consultation and Analysis Methods (CESCAM) of Statistics Canada, to assist in identifying the variables to be used for the new calculation of the GSSI. Statistics Canada has a wide range of databases and recognized expertise in methodology, statistics and analysis. Their work has enabled us to objectively measure the relationship between the various socio-cultural, sociodemographic, and socio-economic characteristics of the covered areas and the educational success among youth. In addition, the Comité de gestion is proud to involve two professors from the Université de Montréal's Faculté des sciences de l'éducation, Marc-André Deniger and Pierre Canisius Kamanzi, both having a lot of expertise related to this project.

#### What's new – continued

Following analyses and recommendations made by experts from Statistics Canada, the Ministère de l'Éducation and the Université de Montréal, a statistical model was produced to create the School success and social deprivation map on the Island of Montreal 2023. This map includes a few new features compared to previous versions:

defined as the secondary graduation rate within a seven-year period (graduation rate). Previously, school success was defined as the school delay rate during secondary school in the areas covered by the model.

School delay rate	$\rightarrow$	Graduation rate	

• The Overall Underprivilege Index is now called the • Although the approach and methods used in the **Global School Success Index.** 

Overall Underprivilege Index	$\rightarrow$	Global School Success Index
onderprivilege index		School Success muex

- The title of the map has been changed to School success and social deprivation map on the Island of Montreal.
- The territory was subdivided by aggregate dissemination area (ADA), while the 2018 version is based on zones made up of dissemination areas (DAs) that are not necessarily contiguous to each other (see section 2.1 for more details).





- For the purposes of this project, school success was For Map 2023, the categorization of school success and social deprivation is divided into five levels, compared with the six in Map 2018. Visual simplicity, improved legibility, simplified comparisons, and reduced subjectivity are some of the reasons for this change. For more information on the motivations behind the thresholds used to establish those levels, please consult the Frequently asked questions (FAQ).
  - development of the map are like those used in previous versions, the **explanatory variables** of the model used for Map 2023 differ from those of 2018. For Map 2018. variables focused on the concept of families. For Map 2023, more than 60 explanatory variables were derived and tested in various linear regression models. These variables could focus on the concepts of persons, parents, households, or families, as defined by Statistics Canada's Census of Population (see section 3.2 for more details). As in the past, the concentration rate per ADA of these variables formed the explanatory variable itself. This made it possible to study the effect of a broader spectrum of sociocultural, socio-demographic, and socio-economic factors as well as the effect of the living environment on school success. Different established methods were applied to select variables, which resulted in several possible models. The expert group met to choose the final model.

#### What's new – continued

- As a result, the **School Success Index** is now calculated using **new variables**: parental education, family mobility, low personal income, and the ethnocultural composition of the living environment (at the individual level). The ADA concentration rate of these variables are the explanatory variables used in the modelling.
- Finally, the 2023 weightings have not been rounded. The regression coefficients are used directly in the calculation of the School Success Index.

All of these changes are further explained in this document.

#### Reminder of the new variables selected:

- Parental education
- Family mobility



The guide to this tenth School success and social deprivation map on the Island of Montreal is divided into three chapters: Education in underprivileged areas. The concept of Social and socio-economic deprivation and its relationship to school success. 2. School success and social deprivation map on the Island of Montreal 2023 by the Comité de gestion de la taxe scolaire de l'île de Montréal. The data used for the Map and the School Success

Index update, as well as the geographic distribution of school success and social deprivation on the Island of Montreal for the year 2023.

#### 3. Methodology.

The approach and methods used in the development of School success and social deprivation map on the Island of Montreal 2023.

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- Low personal income
- Ethnocultural composition

The publication of this new map allows us to take a fresh look at the worrying phenomenon of socioeconomic deprivation and its impact on students' school success, and to reiterate the Comité de gestion's commitment to helping underprivileged areas catch up.



**Chapter 1** 

# **Education in** underprivileged areas

#### 1.1 Social and socio-economic deprivation and school success

Social and socioeconomic deprivation corresponds to a state of deprivation measured by comparing the socioeconomic conditions of individuals or groups of individuals. This state of deprivation means "having less" than the average or most of the people to which one is being compared. When this "having less" stems from socioeconomic conditions, we observe less income, lower levels of education. less access to the job market or less participation in social life. Poverty of "having" is very often accompanied with poverty of "being", such as the loss or lack of self-esteem or recognition from others, and poverty of "power", such as the inability to act on or influence one's physical and social environment.

The negative consequences of social and socio-economic deprivation on the lives of individuals, and students, are manifold, and are not limited to material deprivation. These consequences include food insecurity, residential instability, poor housing conditions, physical and mental health problems, developmental delays in children, parents' lack of interest in their children's education, and social isolation. The impacts of social and socio-economic deprivation are more present and more significant when the deprivation is persistent, lasting for many years, rather than transitory and resulting, for example, from a temporary exclusion from the job market or from any societal commitment.

School success is influenced not only by social and socioeconomic deprivation, but also by the environment, including other factors such as the quality of education, financial and residential stability, availability of educational resources, etc., creating a complex set of determinants. A scientific literature review on the subject was therefore conducted. Some of the factors linked to school success are identified and described in the following section.

#### 1.2 Impact of social and socioeconomic deprivation on school success: factors related to the school success of students

#### **1.2.1** Effects of the living environment: neighborhood and school characteristics

Regardless of their social and socioeconomic status, individuals are influenced in their attitudes and behaviours by the concrete environment in which they live, be it the workplace, the school environment, or the neighbourhood. Within a given socio-economic and socio-demographic environment, the codes of conduct in place and the values that underpin them usually emanate from groups in authority or majority groups. In environments where education is valued and failure at school is perceived negatively, the chances of success and graduation are significantly higher.

In Neighborhoods, Poverty and Children's Well-being: A Review,<sup>1</sup> Anne R. Pebley et Narayan Sastry find that growing up in a poor neighborhood has a negative influence on children's well-being and development, over and above the effects of family socio-economic status. Many specialists consider residential segregation as a key mechanism in the intergenerational transmission of inequalities. They attribute this to the fact that restricting families to neighborhoods where there is poverty reduces their chances of escaping it.

A few in-depth studies have been carried out to understand the environmental factors that can contribute to or hinder a student's school success. For example, living in a rural area could be linked to educational disadvantage.<sup>2</sup> Conversely, other research has shown that the absence of sufficient green space around schools may also be associated with a lack of school success.<sup>3</sup>

Another study showed that the average socio-economic level of a school's students had as much impact on a particular student than his or her own socio-economic status (school environment effect). Indeed, teachers in schools located in socio-economically underprivileged neighborhoods seem to have different expectations of their students than those in schools located in wealthier neighborhoods. Similarly, the amount of homework, the number of rigorous courses taken by students and their sense of security also differed.<sup>4</sup> Furthermore, when students with low-income parents attend higherperforming schools, this tends to reduce their risk of



unhealthy behaviours, such as excessive consumption of alcohol, tobacco and drugs, unprotected sex and involvement in criminal groups.<sup>5</sup>

Studies have also observed the effects of neighborhood on cognitive abilities during childhood, academic performance and school dropout, even when controlling for differences in family socio-economic characteristics. Most studies in this field focus on older children, as it is assumed that the neighborhood's effect on schoolaged children is stronger due to their increased presence in the community.

However, it appears that the characteristics within the community and the neighborhood also exert significant influence on the maintenance of a healthy early-childhood development, and this, in all domains related to school readiness. Several neighborhood characteristics, in fact, seem to contribute to lower school readiness for younger children. These include a neighborhood with a high concentration of individuals who do not speak the official language of the area, have not completed their secondary education, or have a low income, as well as a lack of social cohesion or insufficient community<sup>6,7,8,9</sup> safety.

The geographical concentration of social deprivation is reflected in the concentration of underprivileged students in certain schools. The public elementary schools are usually attended by students who live close to the school; thus, a school located in a deprived area will probably consist of a more underprivileged student population. This can then have an impact on the results these students achieve in secondary school.

#### **1.2.2 Family and parental characteristics**

Parental characteristics and behaviors are by far the most important influence on children's lives. Parental education,<sup>10</sup> as well as socio-economic status (the combination of income and level of education<sup>11</sup>) have been identified by numerous studies as being linked to school success.

Parents' educational expectations,<sup>12</sup> parenting practices (e.g., communication between parent and child, sense of security at home, supervision of the child)<sup>13</sup> and the degree of parental involvement<sup>14</sup> were also found to be very important in predicting students' school success. In addition, it has been shown that children who grew up in homes where there were a lot of books achieve higher levels of education.<sup>15</sup>

Family disruption, such as divorce, violent environment, or death of a parent, have also been shown to be factors impacting school success.<sup>16</sup> In addition, if a student has been the victim of any form of physical or mental abuse or neglect, this will also affect his or her school results.<sup>17</sup>

Moreover, there is abundant evidence that the cumulative effects of these family circumstances have a profound impact on children's school success. Studies in the United States and the United Kingdom show that factors related to family situation are also significantly linked to school dropout and/or poor school performance. These factors include:



- Socioeconomic status: children from poor backgrounds are more likely to drop out of school and/or have a lack of school success.
- **Family structure:** children from large families and single-parent families are more likely to drop out and/or have a lack of school success.
- **Parents' employment status:** children whose parents are unemployed are more likely to drop out and/or have a lack of school success.

reference page

#### **1.2.3** Youth characteristics

Many studies look at the characteristics of youth themselves to explain their educational outcomes. Many studies have examined the school success of immigrant youth,<sup>18</sup> including their generational status<sup>19</sup> (i.e., 1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup> generation immigrant) and ethnic origin<sup>20</sup>, in order to understand some of the lower educational outcomes observed in certain immigrant communities. For example, one study found that the low-income conditions in which some immigrants lived were barriers to school success for immigrant youth.<sup>21</sup>

Various demographic characteristics of youth have been linked to higher or lower academic achievement. These include gender,<sup>22</sup> race,<sup>23</sup> disability<sup>24</sup> and aboriginal identity.<sup>25</sup> In addition, the relationship between school success and students' healthy lifestyle habits has been extensively studied. Lack of sleep,<sup>26</sup> as well as alcohol<sup>27</sup> and cannabis<sup>28</sup> consumption are just a few examples of bad habits linked to lower school success. In terms of health, researchers have also looked at students' mental health and its influence on their school success. The influence of peers on a youth's school success has also been demonstrated.<sup>29</sup>

Finally, extracurricular activities have been shown to have protective effects on youth at risk of a lack of school success. Youth who take part in these activities are less likely to drop out of secondary school.<sup>30</sup>

reference page

In particular, it has also been confirmed that physical activities, including physical education and sport at school, have a positive influence on youth's concentration, memory, and behaviour.<sup>31</sup>





**Chapter 2** 

**School success** and social deprivation map on the Island of Montreal 2023 by the Comité de gestion de la taxe scolaire de l'île de Montréal

The Comité de gestion's Map 2023 is made up of two essential elements: the base map and the School Success Index. These two elements have been updated and adapted to the socio-demographic, socio-cultural and socio-economic evolution of the territory covered by the school service centers and school boards on the Island of Montreal.

Their territory includes the Island of Montreal and the MRC of Vaudreuil-Soulanges, whose **English-speaking** population is served by the Lester B. Pearson School Board. It is important to note that the base map, i.e. the division of the Montreal territory, has changed from the 2018 version, as mentioned in the What's new section at the beginning of this document.

#### 2.1 Division of the Montreal territory into aggregate dissemination areas

The base map corresponds to the way in which the territory is divided up. The territory covered by the school service centers and school boards on the Island of Montreal has been **subdivided into 275 ADAs**. This subdivision is new compared with the previous version of the map, which contained 3,373 DAs grouped into 486 geographical zones. To understand the reasons for this change and to obtain more details, please consult the FAQ.

According to Statistics Canada: "An Aggregate Dissemination Area (ADA) is a dissemination geography created for the Census. ADAs cover the entire country and, where possible, have a population between 5,000 and 15,000 inhabitants based on the previous census population counts. ADAs are created by grouping existing dissemination geographic areas, including census tracts (CTs), census subdivisions (CSDs) or dissemination areas (DAs)".<sup>32</sup> In other words, an ADA groups together several contiguous DAs, the latter being smaller in size.



reference page

### 275 ADA

vs 3.373 DA grouped into 486 zones in the previous version

## 5,000 to 15,000 inhabitants

according to Census population data

#### 2.2 The Global School Success Index

The GSSI is the direct result of predicting the variable of interest, the secondary graduation rate by ADA, on the Island of Montreal and the MRC of Vaudreuil-Soulanges. The prediction of the graduation rate, developed in Chapter 3, uses a combination of the four explanatory variables presented in section 2.2.3. The GSSI is used to derive the "levels of school success" for the school success and social deprivation map on the Island of Montreal 2023.

#### 2.2.1 Target population

The target population for Map 2023 is made up of students attending secondary school and living in the area. This corresponds to the territory covered by school service centers and school boards on the Island of Montreal and in the MRC of Vaudreuil-Soulanges. The purpose of the Map is to categorize students' level of school success according to a geographic breakdown (ADA) based on a model of certain socio-economic and socio-demographic concentration variables.

Parents with higher levels of education tend to be more involved in their child's education, which can have positive effect on their school success.



#### 2.2.2 The data

The data for this project come from three sources: administrative data on the secondary graduation rate for the 2014-2021 cohort of students obtained from the Ministère de l'Éducation du Québec (MÉQ), socio-demographic and socio-economic data from Statistics Canada's 2016 Census of Population. and the Canadian Index of Multiple Deprivation (CIMD), which is derived from Census 2016. To understand why 2016 census data was used rather than 2021 data, please consult the FAQ.

A special data extraction was obtained from the Ministère de l'Éducation du Québec (MÉQ), allowing us to derive graduation rates for the cohort of students who enrolled in Secondary I in 2014-2015 based on their observed graduation status seven years later. These rates were calculated by aggregate dissemination area (ADA), which is the finest level of geography derived from the 2016 Census of Population for which the MÉQ could provide graduation rates while protecting student confidentiality. Sociodemographic and socio-economic data from the 2016 census were extracted and provided by the Canadian Centre for Education Statistics (CCSE) at Statistics Canada. Data from the Canadian Index of Multiple Deprivation, which is publicly accessible,<sup>33</sup> were retrieved by the Centre of Excellence in Statistical Consulting and Analytics Methods (CESCAM) at Statistics Canada.

#### 2.2.3 Variables included in the School Success Index

#### **Parental education:** post-secondary qualification

Parents with higher levels of education tend to be more The third variable of the GSSI captures low personal involved in their children's education, which can have a income, more precisely, measuring the rate of people positive effect on their children's school success. The aged 25 and over living below the low-income cut-off. predictive model for graduation rates chosen by the This variable reflects the socio-economic characteristics Comité de gestion places primary importance on Parental of the neighborhoods in which students live, particularly *Education*. defining the proportion of parents (fathers the ADAs where low-income people are concentrated. and/or mothers) with a post-secondary qualification As mentioned in Chapter 1, the relationship between the among all parents of the ADA having at least one child socioeconomic factors of the living environment and aged 18 or under. This relationship is widespread in the school success is well established in the literature. literature, namely that children's level of education is Families with incomes above the low-income cut-off closely linked to that of their parents. For more information often have more resources to provide a favorable on the choice of using this proportion without distinction learning environment, including access to food security. of sex (father/mother) in our final model, please more educational materials such as books, computers, consult the FAQ. tablets, school supplies, etc., as well as tutors and extracurricular activities. This variable is therefore the Family mobility: socio-economic measure retained for the final model.

high relocation rates

The second variable included in the GSSI captures Family Mobility, measuring the proportion of families with at least one child under 18 who moved in the five years prior to 2016. This measure is crucial for assessing residential stability. Indeed, a high rate of mobility of families and individuals in a given area indicates the presence of residential instability, which, according to research, can influence the graduation rate of students in that living environment. Although the effect of this mobility may vary for each student according to his or her individual situation, it is important to note that frequent mobility suggests the presence of family disruptions, such as divorce, separation, change of workplace or death, and interruptions in school life and difficulties in adapting to new schools, which can affect the school success of youth in these situations.



reference page

#### Low personal income: according to the low-income cut-off

#### **Ethnocultural composition:** according to the CIMD

The final variable in the GSSI captures Ethnocultural *composition*. This is a dimension of the Canadian Index of Multiple Deprivation (CMDI).<sup>34</sup> Developed by Statistics Canada, this index measures social inequalities across four dimensions: residential instability, ethnocultural composition, economic dependency, and situational vulnerability. Given that our objective is to identify ADAs and sectors at risk of social inequality, it is reasonable to consider certain dimensions of this index as factors influencing school success. The elements contributing to each of the CIMD dimensions (those obtained for Quebec) are presented on the following page.

> the proportion of people aged

**25 and** over living below the low-income cut-off

#### Four dimensions of the Canadian Index of Multiple Deprivation: Quebec

Residential instability	Ethnocultural composition	Economic dependence	Situational vulnerability	
Proportion of persons living alone	Proportion of population that is foreign-born	Proportion of population aged 65 and older	Proportion of population that identifies as	
Average number of persons per dwelling	Proportion of population who self-identify as visible minority	Proportion of population participating in labour force (aged 15 and older) <sup>1</sup>	Proportion of dwellings needing major repairs	
Proportion of population that is married or common-law <sup>1</sup>	Proportion of population with no knowledge of	Ratio of employment to population <sup>1</sup>	Proportion of population aged 25-64 without a secondary diploma	
Proportion of dwellings that are owned <sup>1</sup>	either official language (linguistic isolation)	Dependency ratio (population aged 0-14		
Proportion of dwellings that are apartment buildings	Proportion of population who are recent immigrants (arrived in the five years prior to Census)	and aged 65 and older divided by population aged 15-64)		
Proportion of the population who moved within the past five years				

#### 2.2.4 Characteristics and categorization of the **School Success Index**

The GSSI summarizes, in a single measurement, the modeled values obtained through each of the **four variables** selected and detailed in the previous section (parental education, family mobility, low personal income, ethnocultural composition). They are **combined** under a single global index that predicts graduation rates.

#### Figure 1 - Calculation of the School Success Index (GSSI)

GSSI (or predicted graduation rate)

Parental education

Values were grouped into five levels using a class scale applied directly to the GSSI: 75 and under, 75-80, 80-85, 85-90, and 90 and over. School success was categorized from **low** (orange and brick red) through moderate (yellow) to high (light and dark green). The following table illustrates the legend of the five levels of school success according to the GSSI obtained.

Ultimately, only ethnocultural composition was considered significant for our model. The use of an index rather than a variable allows for the inclusion of several factors related to ethnocultural composition under the same explanatory variable. Indeed, the index takes into account the effect of concentrations in ADAs of foreign-born people, as well as those considered to be visible minorities, not proficient in French or English, and having immigrated within the five years prior to the 2016 census. For more information on the effect of this variable in the calculation of the GSSI, **please consult the FAQ**.

Proportion of population that is low-income

<sup>&</sup>lt;sup>1</sup> This indicator was reverse-coded, meaning it was coded opposite of the measure. For example, proportion of population that is married or common-law becomes proportion of population that is single, divorced, separated, or widowed.





- High success
- Very high success

Except for the *L'Île-Dorval* ADA, categorized in gray (because there are few or no families), the distribution of the other 274 ADAs on the Island of Montreal and MRC of Vaudreuil-Soulanges according to their school success levels and corresponding GSSI intervals is presented in Table 2 and Figure 2.



#### Table 2 - Characteristics of school success levels

School success levels	Level range	Number of ADAs	% of ADAs	Average index	Min	Max
Very low success	75 or less	42	15.3	72.120	63.800	74.810
Low success	75 to 80	56	20.4	77.810	75.260	79.890
Moderate success	80 to 85	99	36.1	82.470	80.020	84.990
High success	85 to 90	64	23.4	87.310	85.090	89.870
Very high success	90 and more	13	4.7	91.440	90.030	92.800
Total		274	100	81.487	63.800	92.800



# 2.3 Presentation of the School success and social deprivation map on the Island of Montreal 2023

Map 2023 presents, in **five colors**, the level of school success and social deprivation across the Island of Montreal and the MRC of Vaudreuil-Soulanges. The **colored regions** on Map 2023 **are the ADAs**. Montreal neighborhoods and municipalities in the MRC of Vaudreuil-Soulanges have also been delimitated and identified.

#### 2.3.1 Map of the Island of Montreal

The map **on pages 22 and 23** shows the geographical distribution of school success and social deprivation on the Island of Montreal.

#### 2.3.2 Map of the MRC of Vaudreuil-Soulanges

The map **on pages 24 and 25** shows the geographical distribution of school success and social deprivation in the MRC of Vaudreuil-Soulanges.



School success and social deprivation map on the Island of Montreal

# Island of **Montréal**



#### Pointeaux-Trembles

Rivière des Prait. **Rivière**des-Prairies

Montréal-Est

Anjou

Mercier-Est

Saint-Léonard

Montréal-

Nord

**Mercier-Ouest** 

Rosemont

Hochelaga-Maisonneuve

Longueuil

5 km

Patrie

Plateau Centre-Mont-Royal Sud

Ville-Marie

Petite-

Saint-Saint-**Charles** 

Île des

Soeurs Feure Seint Parte

Verdun

Henri

Côte-

Saint-

-23-



School success and social deprivation map on the Island of Montreal

# MRC of Vaudreuil-**Soulanges**



School success levels

Very high success High success Moderate success Low success Very low success Few or no families Aggregate dissemination area Neighborhood

Sources: Ministère de l'Éducation du Québec; Statistics Canada, 2016 Census of Population.

Île de Montréal

Notre-Damede-l'Île-Perrot

Pointe-des-Cascades



# **Chapter 3** Methodology

#### 3.1 Base map configuration

Map 2023 provides a detailed representation of the region, delineated into neighborhoods and ADAs. It shows five school success levels, with each ADA colored according to its school success levels, as determined by our statistical model (see section 3.2). Of the 275 ADAs covering the Island of Montreal and the MRC of Vaudreuil-Soulanges, 274 were colored according to their GSSI, leaving L'Île-Dorval in gray, since it did not have enough data to make an adequate prediction. It should be noted that an ADA is generally located entirely within a single neighborhood, but that it may, although rarely, extend over an area touching several neighborhoods.

The secondary graduation rate is the key variable used to model school success rates.



#### **3.2 Modeling and choice of variables** for calculating the School Success Index

A multivariate linear regression statistical model is used to model the GSSI. The variable of interest (or dependent variable) is the secondary graduation rate of students in the 2014-2021 cohort. The explanatory variables (or independent variables) were derived from socio-economic and socio-demographic data from the 2016 Census of population. To understand why 2016 census data and not 2021 data were used, please consult the FAQ.

A total of **60 variables were considered**, covering areas such as education, income, immigration status, official languages, CIMD, residential mobility, etc., and subpopulation levels such as individuals, families, households, and parents. In fact, the four sub-population levels considered were:

- 1. people aged 25 and over,
- 2. parents over 25 with at least one child under 18,
- 3. all households,
- 4. households with at least one child under 18 (families).

These data were available for all 275 ADAs in Montreal and the MRC of Vaudreuil-Soulanges. The variables used in the modeling were transformed into proportions (or rates) to standardize the effect of variation in subpopulation levels' sizes across ADAs, and thus facilitate their interpretation in the model.

CIMD are provided by the Canadian Centre for Justice and Community Safety Statistics of Statistics Canada. These indices are derived by factor analysis from 2016 census data to give the four dimensions shown on page 18.

Explanatory variables (or independent variables) were derived from socio-economic and socio-demographic data from the 2016 Census of population.

To ensure model stability, potentially influential or outlier data were excluded. ADAs with fewer than 30 students were excluded, as they might be less representative of the year-on-year school success rates obtained in these ADAs. In addition, ADAs whose predictive model produced very high standardized residuals were set aside during model creation, to add more stability to the model. In the end, 237 ADAs were used in the modeling.

To select the final four explanatory variables for modeling the secondary graduation rate (section 2.2.3), a few established variable selection methods were applied according to various parameters in goal of creating different modeling scenarios.

For each scenario, we checked whether there was a problem of multicollinearity<sup>35</sup> between the explanatory variables of the models obtained. We calculated the Variance Inflation Factor (VIF), a measure used to assess the presence of multicollinearity in a multivariate linear regression model, for each of the explanatory variables, to ensure that they were below 10. If the VIF of an explanatory variable was greater than 10, we were removing that variable from the model.

To assess the parsimony and quality of the resulting model, we calculated the "adjusted R-squared" coefficient of determination, a measure of how well the variation of the variable of interest (here, the secondary graduation rate) is explained by the explanatory variables retained in the model. The closer the value of this measure is to 1, the better the model is adjusted, meaning that the explanatory variables explain the variable of interest well.

#### **3.3 Final model**

After applying the methodology outlined in the previous section, the various models obtained were examined and discussed in detail by the expert team members. At this point, all the models were theoretically validated and relevant to the project. More subjective criteria related to model parsimony and the themes covered by the variables themselves were then considered. Finally, after discussions between the team members, the model chosen for calculating the GSSI was the following.

#### **Table 3 –** Multivariate linear regression model used to calculate the 2023 School Success Index

Variable	Correlation (r)	Cœfficient (β)	P-value	Contribution
Intercept	-	0.536	< 0.001	53.6%
Parental education	0.53	0.422	< 0.001	35.3%
Family mobility	-0.479	-0.499	< 0.001	-7.1%
Low personal income	-0.536	-0.37	< 0.001	-5.3%
Ethnocultural composition	-0.1	0.1666	< 0.001	5.4%

Adjusted R-squared

0.53



#### **3.4 Model interpretation** (variable weighting)

According to the multivariate linear regression model presented above, the estimate of our variable of interest is calculated by a linear combination of the four explanatory variables and their respective regression coefficients. Table 3 presents a complete summary of the model.

The Variable column represents the four socioeconomic and socio-demographic explanatory variables used to calculate the GSSI. The intercept of the model is also included.

The Correlation (r) column represents the univariate correlation between the explanatory variable and the graduation rate. Correlation is a measure quantifying the linear relationship existing between two variables.

The **Cœfficient** (B) column represents the quantified effect of the variable on the graduation rate. In other words, it quantifies the average increase (positive coefficient) or decrease (negative coefficient) in the graduation rate when the explanatory variable increases by one unit, while keeping the other variables unchanged. Thus, the regression coefficients are multiplied by the concentration rates of each explanatory variable in each ADA to obtain their value for the Global School Success Index (GSSI). The GSSI values for each ADA form the basis for creating the Map (see section 2.3).

The **P-value** column is a probability representing the significance of the variable in the model. The smaller the p-value, the more significant the variable. The significance threshold used in our context is 0.05 (5%). When the scenarios were created, all the variables retained in the models were significant.

The **Contribution** column represents the Global average contribution of each variable across the ADAs, i.e., the average percentage increase (or decrease) in the graduation rate for all ADAs on the Island of Montreal and the MRC of Vaudreuil-Soulanges in the regression model linked to this explanatory variable. Parental education is the variable with the greatest influence on the graduation rate (+), followed by Family mobility (-), then Low personal income (-) and Ethnocultural composition (+) which have a similar contribution. The intercept indicates an average graduation rate threshold around which the explanatory variables add or subtract value, depending on the multiplication of the regression coefficients by the concentration rates of the explanatory variables.



# Conclusion

The influence of economic and social vulnerability is strongly felt in many aspects of education, particularly when it comes to secondary graduation rates. However, while these challenges tend to persist, they are not insurmountable, and education and targeted investment play a crucial role in overcoming them.

It is against this backdrop that the Comité de gestion has developed the School success and social deprivation map on the Island of Montreal 2023, a tool specially designed to reflect Montreal's reality. The Map provides a clear vision of the social and economic disparities that prevail on our territory and serves as the basis for an equitable distribution of financial resources from school taxes and investments. The primary objective is to direct these resources judiciously towards schools that cater to the most vulnerable students, with the aim of promoting equality of opportunity. It is essential to continue this approach to counter potential obstacles and encourage equal opportunities.

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Index of Multiple Deprivation: User Guide.

# Frequently Asked Questions (FAQ)

This appendix contains frequently asked questions on the methodology used to construct the School success and social deprivation map on the Island of Montreal.

> To simplify the text, the word "Map" refers to the Comité de gestion de la taxe scolaire de l'île de Montréal's School success and social deprivation map on the Island of Montreal.

Similarly, the following terms are abbreviated: "census" refers to Statistics Canada's Census of Population, "persons" refers to individuals aged 25 and over, "parents" refers to parents with at least one child under 18, and "families" refers to households containing at least one child under 18.

### What is the difference between a DA and an ADA?

Aggregate dissemination areas (ADAs) were first derived for Statistics Canada's 2016 Census of Population. As the name suggests, this is a less detailed **geography** than the dissemination area (DA), formed by grouping these last ones according to rules pre-established by the agency's Geography Division. The ADAs were also used for the 2021 census.

For further details on the formation of these geographic levels, please consult this link.

### Why is there less color on Map 2023 than on Map 2018?

Map 2018 detailed deprivation concentration levels by dissemination area (DA) from the 2016 census, while Map 2023 shows these levels by aggregate dissemination area (ADA) from the same census. There are fewer ADAs than DAs according to Statistics Canada's geographic definitions.

In addition, the **2018 methodology** used regions called "zones" created from available DAs. The DAs forming these zones had similar socio-economic and socio-demographic characteristics and had to be in the same part of town, although **not necessarily contiguous**.

To illustrate this with an example, if we compare the Ahuntsic neighborhood for the respective 2018 and 2023 maps (see figures opposite), we can see several small colored "dots" on Map 2018, which was drawn up from zones made up of DAs. These are the non-contiguous DAs of the zones. As for Map 2023, we can see larger colored zones, since this new version of the map is **built from ADAs**, which are formed from contiguous DAs.

on the effect of living environment on school success than the 2018 one. Thus, "zones" were simply defined as ADAs. It should be noted that all the DAs comprising these ADAs are contiguous and located in the same area, according to Statistics Canada's geographic definitions.

#### Figure A1 - Ahuntsic neighborhood, Map 2018 vs. Map 2023



2023



In other words, the 2023 methodology focuses more N.B. To simplify Map 2023, DA boundaries have not been added.

-35-

### Why did you change the map zones?

The 2018 methodology used regions called "zones" created from available DAs. This methodology had been developed for Map 2013, which was based on 2011 census data. The concept of ADA did not exist at that time. DAs forming these zones had similar socio-economic and socio-demographic characteristics and had to be located in the same part of the city, though not necessarily contiguous. Although theoretically well defined, the formation of these zones remained an exercise involving a subjective component. In fact, a total number of families in the zone was targeted, but this was not always to respect this, as the socio-demographic composition is subject to several ups and downs over time. Furthermore, to respect this methodological constraint, some zones were covering ADs that were guite far apart geographically, which homogenized the zones. While perfectly valid from a modeling point of view, it reduced the effect of the living environment on school success of students in these zones.

The 2023 methodology on its stand focuses more on the effect of living environment on students' school success. Thus, the "zones" have simply been chosen to be defined as the ADAs, since:

- ADAs are established by an entity independent of the Comité de gestion, i.e. Statistics Canada,
- the "zones" will be more stable from one map to the next, and
- the ADAs form a zone of urban proximity that may correspond to the desired concept of the living environment.

In fact, all the DAs making up these ADAs are contiguous and located in the same area, according to Statistics Canada's geographical definitions. ADAs will also be derived and become more stable in the upcoming censuses.

### Why have you changed the categorization of Map 2023, particularly by reducing the number of levels?

The GSSI values have been grouped into five levels rather than six. as this simplification makes it easier to read the Map and to compare the different zones. Furthermore, it makes it possible to cover the distribution of calculated GSSI in five intervals of relatively uniform length. By using five levels, we also reduce complexity while retaining an informative representation of disparities in school success.

### It looks like there are fewer red areas on Map 2023. What will be the impact on the distribution of funds to schools?

2018. Also, the way in which the is different between the two years.

For Map 2018, the GSSI value was not used to derive concentration levels. Instead, they were allocated proportionally based on the number of zones. These proportions balanced the number of more deprived zones with the number of less deprived zones.

according to the GSSI values. Ranges of values were pre-established, and the levels of school success concentration by ADA are

Map 2023 uses five levels of catego- are fewer severely underprivileged rization, compared to six for Map areas (low school success rates) on Map 2023, which in any case seems level of concentration is determined to us to reflect a little more the economic reality of Montreal and the surrounding area.

Most ADAs on Map 2023 (36.1%, see table 2 in section 2.2.3) are in yellow, since most of the distribution of calculated GSSI are in the interval [80, 85]. An ADA whose GSSI was very close to the bounds of pre-established intervals could have ended up in a different class of For Map 2023, it was decided ins- school success, had the intervals tead to allocate concentration levels been pre-determined otherwise. In other words, an GSSI that was close to the established limits could have ended up in a different level. For example, an GSSI of 75.6 calculated respecting these. As a result, there in an ADA in the Saint-Michel

### Is the variable of interest studied different in 2023 than in 2018?

Yes.

For Map 2018, the variable of interest was the rate of school delay during secondary education in the areas covered by the model.

For Map 2023, the variable of inte- most up-to-date cohorts of sturest was secondary graduation rates after seven years in the ADAs covered by the model. Both variables were derived from the

neighborhood was classified as school success level 2 - orange, because the GSSI is in the interval [75, 80]. However, if we had pre-established those levels 1 - brick red and 2 - orange had respectively had intervals [less than 76] and [76, 80] for example, then this same ADA would have been classified as level 1 - brick red.

It is important to note that these intervals and classifications under five levels only contribute to the look of Map 2023, but do not directly affect the monetary allocation that each school in a neighborhood/ADA will receive. A rigorous formula, based primarily on the order of the GSSI calculated by ADA, will determine this allocation.

dents tracked by the MÉQ at the time the map was created.

### In the 2023 model, why did you use explanatory variables from the 2016 census and not from the 2021 census?

#### For two main reasons.

Although most of the 2021 census data were available when we conducted the study in early 2023, some variables had not yet been published by Statistics Canada. This was particularly the case for the Canadian Index of Multiple Deprivation (CIMD), one of which was applied again in 2023? retained in the final model.

In addition, the cohort of students tracked by the MÉQ was that of 2014-2021. After discussions with several experts within the working group, and knowing that the reference year used by the MÉQ was 2014 and not 2021 for this cohort, it was decided that the census year had to be the one closest to the cohort's reference year. i.e. 2016 (vs. 2014). This is because **secondary graduation** rates by ADA were provided to us by the MÉQ based on the location of students when they enrolled in Secondary 1 in September 2014.



# Why was the 2018 model not

#### For two main reasons.

The model used for the last two maps was created for the purposes of Map 2013 and was based on 2011 census data and the literature on socio-demographic and socio-economic variables affecting school success at the time. The model was used as is for Map 2018, but applied to the most up-to-date census data, i.e. 2016. As the composition of the areas covered by the map had changed both socio-demographically and socio-economically, as had the scientific literature on the subject, we felt it necessary to update the model.

In addition, by collaborating with methodological and educational experts from Statistics Canada, we were able to access a wider range of explanatory variables available for our model, mainly from the Census of Population conducted by the agency. As a result, we were able to apply a modeling process that covered more of the socio-demographic and socio-economic concepts that can affect school success than in the past. After applying established variable selection methods, a few possible model scenarios valid for our project were selected and discussed internally. A final model was then chosen after further deliberation.

N.B. As in 2018, the choice of the final proposed model by the methodologists and the Comité de gestion was analyzed and corroborated by a committee of education experts from the Université de Montréal.

### What is a Global School Success Index?

It is an index derived by modeling secondary graduation rates based on various socio-economic and socio-demographic factors, using explanatory variables that focus on the concentration of these factors. Specifically, the higher the GSSI, the higher the level of school success. This linear scale makes it possible to make comparisons from one GSSI to another, and ultimately to compare ADAs in neighborhoods in terms of school success and social deprivation.

A regression model was applied to some sixty of these variables derived from the Census of Population. A variable selection method was used to reduce the number of significant variables retained, to obtain a parsimonious model (balance point between too many and too few explanatory variables), with no multicollinearity (i.e., low linear dependence between variables retained).

Once the final model is chosen, the GSSI is simply the result of applying this model to the derived concentration rates of the model's explanatory variables at the ADA level.



This relationship is widespread in the literature (see section 1.2.2), namely that children's level of education is closely linked to that of their parents, and the results of this analysis confirm this, since the explanatory variable that contributed most to the variation in secondary graduation rates was the parental education variable.

### Why has the mother's education level variable been replaced by the parental education one?

In the case of parental education related variables, three variables were tested: the concentration of mothers with post-secondary education, the concentration of fathers with post-secondary education and the concentration of parents with post-secondary education. These three variables produced roughly similar results in terms of model quality.

In the end, the Comité de gestion and experts decided to maintain the concentration of parents with post-secondary education, so as not to appear to favor one sex over the other in the message conveyed by the choice of the final model.

### How is the variable related to family mobility (within Montreal) defined?

The variable that had the second largest contribution to the variation in secondary graduation rates is **parental mobility within a given ADA**. This variable measures the concentration of families who have moved in the last five years based on responses to the 2016 Census of Population. More specifically, it measures the concentration of families who lived at a different civic address than the one given in the 2016 Census of Population during the five years preceding that census, whether in Montreal, elsewhere in Quebec or outside of Canada.

For more information, see the questions in the MOBILITY section of the official census questionnaire via this link.

When this variable has a high value in a given ADA, it indicates a concentration of families whose dwelling was not fixed in the recent past. While the fact of having moved in the last five years is not necessarily negative for a particular student, as each family situation is unique, the fact that he or she lives in a neighborhood where individuals (and families) are more likely to move indicates a certain residential instability in his or her environment.

### Why is the model's only economic variable limited to low personal income and not to other types of income (median household income, for example)?

Poverty (of parents and environment) is another characteristic recognized in the literature to have significant effects on student's school success. It should be noted that several variables specifically measuring the income and employment characteristics of families, households and individuals were available for modelling. However, most of them were eliminated for reasons of multicollinearity or non-significance in the models.

In the end, it was the proportion of people below the low-income cut-off in each ADA that achieved the greatest significance during the selection of the model's variables.

This variable reflects a measure of the poverty of the ADA in which the students lived and proved robust in almost all the models evaluated. Note that during our analyses (correlations, different modeling approaches, regressions), we were able to observe that the variable was a better predictor than the median (or average) income previously used in the model.

One possible explanation is simply that having a concentration of very wealthy or relatively affluent families results in roughly the same rates. secondary graduation However, the effect is much more significant when there is a higher concentration of underprivileged adults (or those below the low-income cut-off).



To represent the concept of immigration and ethnocultural factors in the model, the Comité de gestion and the experts chose the CIMD ethno-cultural composition index. We say chose, because a few other explanatory variables related to these factors were also significant in the models evaluated. This variable was chosen mainly because it encompasses several facets of immigration and socio-cultural characteristics. In fact, this index makes it possible to identify ADAs in which there is a concentration of people who may be vulnerable for a multitude of reasons: they are immigrants, they declare themselves to be part of a visible minority, they do not have a good knowledge of either of the two official languages, or they are recent immigrants.

Interestingly, in the final model, after controlling for parental education. family mobility, and low personal income, this index is **positively** associated with graduation rates. This means that ADAs with a higher concentration of the groups described above, all other things being equal with regard to the other three explanatory variables, are more likely to have higher graduation rates. The Global School Success Index calculated from the model's regression coefficients, reflects this result.

One hypothesis raised by the experts is that this may reflect Canada's current immigration policies (primarily so-called "economic" immigration), which give priority to highly-educated immigrants who are themselves highly motivated by their children's education. An interesting observation we discovered when analyzing the results was that the immigration variable was not at all related (independent) to the Y, unlike the other variables retained in the models. However, when it was crossed with the other explanatory variables, a dependency effect (known as nested effect) became significant. For example, it could be argued that, for two ADAs with equal rates of people below the low-income cut-off, the one with the higher immigrant ratio tends to have a higher graduation rate. This could be explained, for example, by a greater desire on the part of less affluent newcomers to push for better schooling for their offspring.

### What does an increase in the regression coefficient represent in the model?

The concentration rate of the explanatory variable multiplied by its regression coefficient gives the increase (or decrease) in the graduation rate in the ADA. For example, if the concentration rate of parents with a post-secondary gualification in the ADA (parental edu*cation* variable having a regression coefficient  $\beta$  = 0.53) is 0.80, then the predicted graduation rate in this ADA, all else being equal, will increase by  $0.53 \times 0.80 = 0.424$ .

Of course, the increase/decrease in the total predicted graduation rate is represented by the complete linear combination of the four explanatory variables and their respective regression coefficients. The GSSI for each ADA is derived by applying the model (the coefficients) to the concentration rates in each ADA (four explanatory variables kept in the model).

# Endnotes

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- <sup>33</sup> See link.
- <sup>34</sup> CIMD See link.
- <sup>35</sup> Multicollinearity occurs when there is a strong correlation between the explanatory variables of a multiple linear regression model. This can make individual interpretation of the regression cœfficients difficult by unnecessarily increasing their variance, make the results unstable and affect significance tests.

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