How school type, language, special education services, family income, and parental education level influence OSSLT first attempt results in Ontario schools

STA302 Final Project Part 1

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March 19, 2025

1 Introduction

The Ontario Secondary School English Literacy Test (OSSLT) is mandatory for high school graduation in Ontario, therefore English language learning is a significant focus for both parents and students. This paper aims to investigate how school type, language, special education services, family income, and parental education level influence OSSLT first attempt results in Ontario schools. Zhang et al. (2020) found that family income and parental education level significantly contribute to a student's academic success. Their study was conducted in China, and revealed that higher family income and more advanced parental education are correlated with better student performance. This supports and shapes our hypothesis that students with higher family income and parental education level will perform better on the OSSLT. Bernhofer and Tonin (2022) showed that students perform better when taught in their first language, which questions if English language school students will perform better on the OSSLT compared to those in non-English language schools. Lastly, Aseery (2024) explored how technology and multimedia elements in religious education classes could enhance English language learning. Aseery's findings suggest that multimedia tools in religious education classes improve student engagement and motivation, which enhances learning outcomes. We would expect schools supplying these technologies in 2025. Therefore, we hypothesize that religious schools will have higher OSSLT pass rates.

While Zhang et al. (2020) concluded that higher income and parental education level lead to higher achievement, there are exceptions, as many successful individuals come from lower-income backgrounds. We also expect that students receiving special education services may

Table 1: OSSLT First Attempt Pass Rate Descriptive Statistics

	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
OSSLT_First_Attempt_	737	82.45	11.93	85	83.92	10.38	0	100	100	-1.93	6.93	0.44

perform worse on the OSSLT due to specific learning disabilities, despite receiving accommodations. This research question fits well with the concept of multiple linear regression, which examines how multiple predictor variables collaboratively influence a response variable. Therefore, we have selected multiple linear regression as our analysis method. Since the main goal is to observe patterns between variables, this model will focus on interpretability.

This research will benefit those seeking an accurate analysis of the factors that influence English learning outcomes, particularly in the context of the OSSLT. The response variable, OSSLT results, serves as an effective measure of students' English proficiency, as it is both a pass/fail test and provides continuous data.

2 Data description

The dataset, available on the Ontario Data Catalogue (Ontario 2024b), provides insights into schools in Ontario, supporting policy-making, and educational research. This study repurposes it to investigate and predict the OSSLT first-attempt pass rate. Data were collected from schools, school boards, EQAO, and Statistics Canada through online forms, surveys, phone interviews, and in-person visits, then compiled by Ontario Data Catalogue (Ontario 2024a).

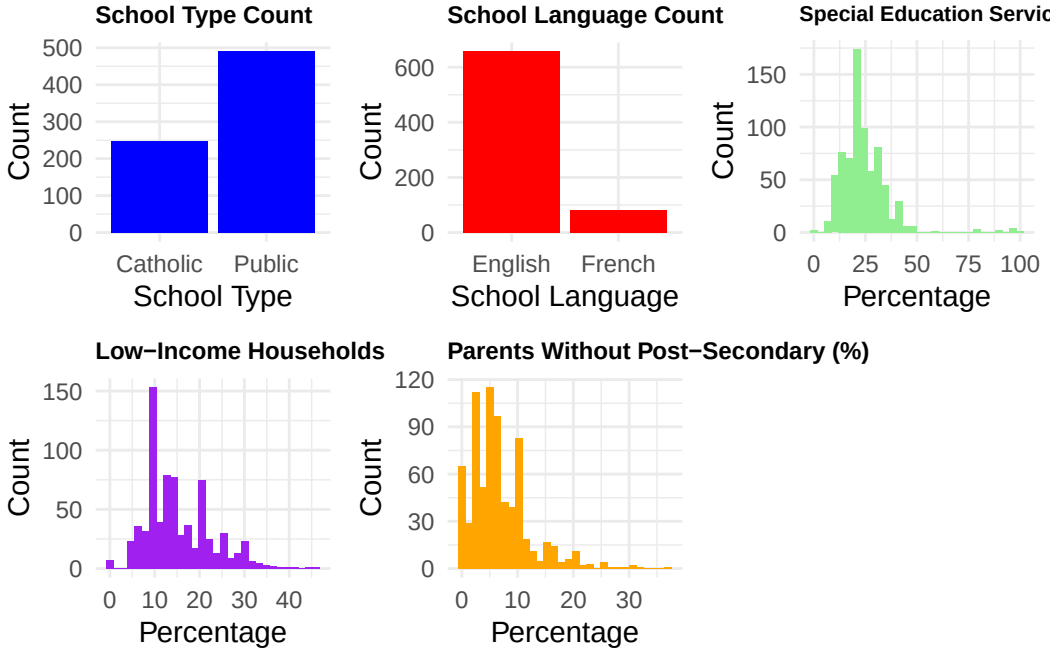
The `OSSLT_First_Attempt_PassRate`, the response variable, measures the percentage of students passing Ontario Secondary School Literacy Test on their first attempt, ranging from 0 to 100. The mean of 82.45 and median of 85 indicate high pass rates. The dataset originally had 4,926 observations, reduced to 737 after cleaning, ensuring statistical reliability. Despite being bounded, the pass rate is continuous, suitable for linear regression.

School Type is categorical, with two types: Catholic and Public. Most schools are public. Cheema (2024) noted, private schools generally outperform public schools in literacy. We expect Catholic schools to have higher OSSLT pass rates due to structured curriculum and discipline.

School Language is binary, English or French. Most schools operate in English, which is expected to correlate with higher OSSLT pass rates.

Students receiving special education services often exhibit lower literacy achievement and slower progress, as noted by Vaughn and Wanzek (2014). Our model aims to capture this pattern. The mean of this predictor variable is 24.07%, with a median of 22%, includes outliers where 100% of students receive special education services.

Table 2: Histograms for Selected Predictors



The percentage of school-aged children in low-income households has a mean of 15.27% and skewness of 0.88, indicating some schools have significantly higher concentrations. As Nadeem, Akhtar, and Ahmad (2021) found, lower-income students often have lower literacy skills, which we expect to correlate with lower OSSLT pass rates.

The percentage of students whose parents lack post-secondary credentials averages 6.76%, with skewness of 1.56 and kurtosis of 3.73, suggesting a slight right skew. As Davis-Kean, Tighe, and Waters (2021) states, parental education influences children's academic success, making this a relevant predictor.

3 Preliminary results

	Coefficient	Standard_Error	t_Statistic	p_Value
(Intercept)	105.1756826	1.00518235	104.633435	0.000000e+00
School_TypePublic	-1.0689414	0.65175574	-1.640095	1.014156e-01
School_LanguageFrench	5.4585354	0.98401923	5.547184	4.059800e-08
Special_Ed_Pct	-0.6210042	0.02613604	-23.760460	6.428134e-93
Low_Income_Pct	-0.2957966	0.04835594	-6.117068	1.552365e-09
No_Parent_Degree_Pct	-0.4645510	0.06539550	-7.103716	2.886850e-12

3.1 Residual Analysis

3.1.1 Linear Models Assumptions:

1. **Linearity**

$$E(Y_i|X = \mathbf{x}_i) = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip}$$

2. **Constant Error Variance (Homoscedasticity)**

$$Var(Y_i|X = \mathbf{x}_i) = \sigma^2$$

3. **Uncorrelated and Normal Errors**

$$Cov(e_i, e_j) = 0 \text{ for } i \neq j \text{ and } e_i \sim N(0, \sigma^2)$$

3.1.2 Assumption Check

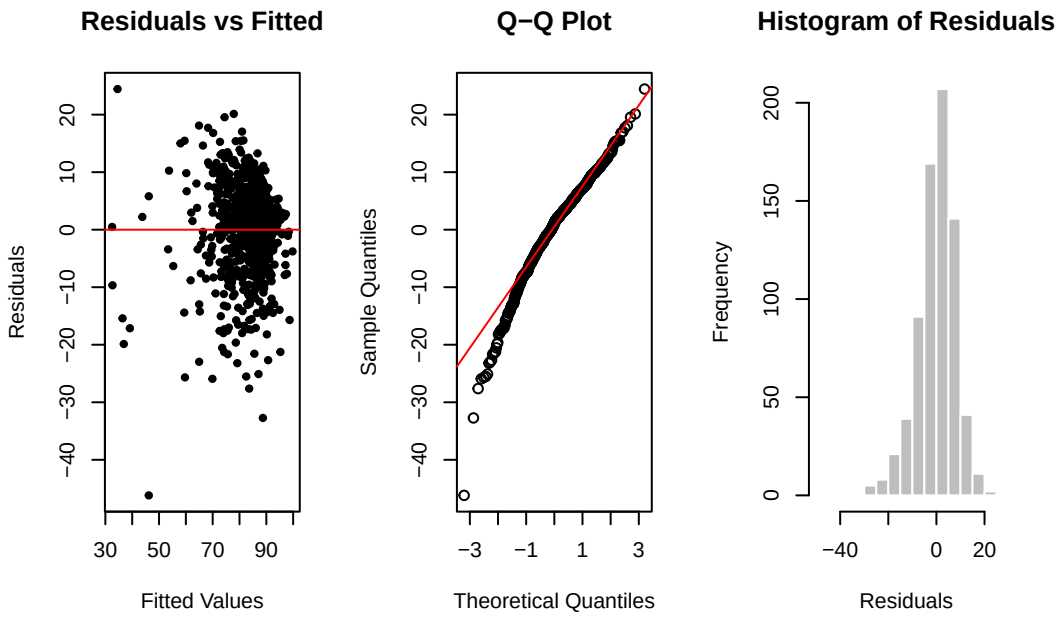


Figure 1: Residual Plots

1. **Linearity & Homoscedasticity:** The residuals vs. fitted plot shows no clear pattern, suggesting linearity. Slight heteroscedasticity is observed.

2. **Normality:** The Q-Q plot and the histogram of residuals suggest residuals are approximately normal, though slight deviations exist at the left tail.
3. **Independence:** No evident pattern in the residual plot suggests residuals are independent.

3.2 Model Interpretation & Discussion

3.2.1 Key Findings and interpretation

- The **intercept (105.18)** represents the estimated pass rate for a **Catholic, English-language school with 0% special education, 0% low-income students, and 0% students whose parents have no degree**. This provides a reference point for understanding the model's predictions.
- **School Language (French vs. English)** and the three numeric variables (**Special_Ed_Pct, Low_Income_Pct, No_Parent_Degree_Pct**) are strongly associated with the **OSSLT pass rate**.
- **School Type (Public vs. Catholic)** does not show a statistically significant difference in pass rate in this model.
- Higher proportions of **special education students, low-income students, and students whose parents have no degree** are each associated with a **lower pass rate**.
- Conversely, being a **French-language school** is associated with a **higher pass rate** relative to the English.
- The model explains **54% of the variation in pass rates**, which is reasonable for educational data, suggesting these variables collectively have a substantial but not complete ability to predict pass rates.

3.2.2 Comparison to Literature

Our findings align with prior research while offering insights specific to Ontario:

- **Family Income & Parental Education:** Consistent with Zhang et al. (2020), our results confirm that higher family income and parental education correlate with better OSSLT pass rates.
- **School Language:** Contrary to Bernhofer and Tonin (2022), our study shows French-language schools had higher OSSLT pass rates than English-language schools, indicating other factors like curriculum or funding may play a role. Further investigation is needed.
- **Special Education:** Higher proportions of special education students negatively impact OSSLT success, aligning with expectations.

- **School Type:** No significant difference was found between public and Catholic schools, despite Aseery (2024) suggesting that religious schools may benefit from enhanced multimedia learning tools.

Table 3: Descriptive Statistics for Selected Predictors

	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
School_Type*	737	3.66	1.89	5	3.82	0.00	1	5	4	-0.70	-1.52	0.07
School_Language*	737	1.11	0.31	1	1.01	0.00	1	2	1	2.51	4.31	0.01
Special_Ed_Pct	737	24.07	11.53	22	22.91	8.90	0	100	100	2.72	13.46	0.42
Low_Income_Pct	737	15.27	7.30	13	14.58	5.93	0	46	46	0.88	0.66	0.27
No_Parent_Degree_Pct	737	6.76	5.42	5	6.06	4.45	0	37	37	1.56	3.73	0.20

A Appendix

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