Mathematical Modelling and Applications
2021; 6(4): 107-116
http://www.sciencepublishinggroup.com/j/mma
doi: 10.11648/j.mma.20210604.14
ISSN: 2575-1786 (Print); ISSN: 2575-1794 (Online)

Inequity in Education: Three-factor and Longitudinal Analysis

Mandi Jin

Western Canada High School, Calgary, Canada

Email address:
mandij2@educbe.ca

To cite this article:
Mandi Jin. Inequity in Education: Three-factor and Longitudinal Analysis. *Mathematical Modelling and Applications*. Vol. 6, No. 4, 2021, pp. 107-116. doi: 10.11648/j.mma.20210604.14

Received: April 10, 2021; **Accepted:** July 27, 2021; **Published:** December 24, 2021

Abstract: This study was conducted to find a more equitable education system for all students regardless of ethnicity, social status, gender, or even problems arising as a result of the Covid-19 pandemic. The effects of major factors that played a critical role on indicators of equity in education were analyzed. A data set from World Inequity Database on Education (WIDE) was used to gather information to estimate the inequity gap for different indicators and countries. The upper secondary completion rate was selected within this database to explore inequity in worldwide education and several stacked bar plots were drawn to describe the differences among demographics and incomes of countries. The learning achievement in reading(upper secondary) was chosen to explore inequity in education in Canada. A three-factor analysis model was built to study the effects of gender, location, wealth, and their interaction on learning achievement in reading. After model selection and model diagnosis, an additive model was chosen as the final model and it proved that there resided significant main effects. Also, a longitudinal model was built to explore whether observations of learning achievement in reading varied among the different years with four different levels as covariate variables. Three models related to repeated measures design were built, and the final model was chosen based on the AIC value. As a result, it provided a clear indication that the government should take responsibility and well-needed actions to eliminate inequity in education for many disparities that exist within comparisons between groups. Examples are: gender, rural or urban areas, and the social status of families.

Keywords: Equity, Education, Three-factor Analysis, Longitudinal Analysis, Visualization

1. Introduction

The recognition of education inequity has been a circling issue for a long period of time. Researchers have put in an abundant amount of effort in order to promote equity in education [2-6]. Educational inequity is the inconsistent distribution of scholarly assets, including but not limited to: qualified and experienced instructors, books, school funding, and innovations to socially prohibited networks. The students affected by this issue will, in general, be truly impeded and mistreated. A greater number of times than not, people having a place with these underestimated bunches are additionally denied admittance to schools with bountiful assets. Inequity prompts significant contrasts in the educational achievement or effectiveness of these people and eventually stifles social and monetary portability.

An evenhanded education framework, which furnishes equivalent freedoms to students with the most help and needs, is an important part of tending to the widening income inequity issue, presently at its most significant level since the late 1800s. Education inequity is the main key to a plentiful measure of social issues inside our general public. For instance, in the United States, inequity in education is the main explanation regarding why they have the most noteworthy newborn child mortality, maternal passing, and jail populace rate of any developed country. Inequity inside the education framework hampers monetary development and compromises the majority rules system.

All through the world, there have been constant endeavors to change education at all levels. With various causes that are profoundly established ever, society, and culture, this inequity is hard to annihilate. This is on the grounds that it is an issue that has developed dramatically consistently and has had an abundant amount of influence on the whole world. Albeit troublesome, education is essential to society's progress ahead. It gives a sense of promotion towards citizenship, personality, the balance of chance and social incorporation, social attachment just as monetary development and business and thus, fairness is broadly advanced. The acknowledgment of worldwide educational inequity has prompted the appropriation of the United Nations Sustainable Development Goal 4; which advances comprehensive and fair quality education for all.

The motivation behind this investigation was to show the education status worldwide and exhibitions of why this is a fundamental issue that should be recognized and settled. The utilization of various absolute variables like sexual orientation, country and social status was fused to perceive the recognizable proof of this developing issue. Topics that were acknowledged in this study, but not limited to:

1. Education conditions in countries around the globe; and especially within Canada.
2. Why this problem needed to be addressed, as well as the importance of equity in the education system.
3. What still needs to be done, especially as a result of the Covid 19 pandemic.

2. Methods

2.1. Graphical Analysis for Worldwide Data

This report utilized the World Inequality Database on Education (WIDE) to perform the overall analysis. WIDE focused on the powerful influence of different aspects, such as wealth, gender, ethnicity and location, which played an essential role in not only education, but also the lives of people all around the world. To add to this, WIDE also provided information regarding education inequality by different time periods as well as the different levels across countries and between groups within countries, aiming to help create policy design and draw public attention to promote equity in education. This dataset was explicit and straightforward for people to get access. The data was distributed for different indicators on access, completion, learning, and also for different countries. For each specific indicator and each country, there was detailed data based on disparities such as gender, location and wealth.

This report emphasized on worldwide data in order to have a general idea of the education situation among different countries. An indicator on access and completion was explored here: upper secondary completion rate since there was a great interest in education of upper secondary students. For the upper secondary completion rate, young people aged between 20 and 29 were chosen and all countries were divided into subgroups based on their locations and domestic income. For example, countries were divided into 6 sub-groups based on their locations: Sub-Saharan Africa, Central and Southern Asia, Northern Africa and Western Asia, Eastern and South-eastern Asia, Latin America and the Caribbean, and Europe and Northern America. At the same time, countries were divided into 4 sub-groups based on their domestic income: Low income countries, Lower middle income countries, Upper middle income countries, and High income countries. For each sub-group, there was comparison within the difference in upper secondary completion rate based on the following disparities: gender, location, region, wealth, ethnicity, and religion. Two stacked bar plots were generated in order to provide a better understanding of the results.

2.2. Statistical Analysis for Canada Data

After having a basic understanding of inequity around the world, the next critical step was to know the situation in Canada. To evaluate the performance of Canada, an indicator on learning was explored: Learning achievement in reading (upper secondary). For this indicator, there was detailed data by different years and levels, which was based on disparities: gender, location, wealth, and the language spoken at home. Statistical models, including three-factor analysis and longitudinal analysis, were built to attain further understanding of the situation in Canada.

2.2.1. Three-factor Analysis

In statistics, a factorial experiment design is an experiment whose design consists of two or more factors, each with several values or levels, and whose experimental units take on all possible combinations of these levels across all such factors. Such an experiment allows researchers to study the effect of each factor on the response variable, as well as the effects of interactions between factors on the response variable.

Three-factor analysis model [7-8], just as its name implies, tackles three factors in the study. Suppose that we have three factors: factor A has a levels, factor B has b levels, factor C has c levels, and there were n observations for each of the abc combinations of the factors. Let Y_{ijkm} be the m^{th} observation when factor A is at level i, factor B is at level j, and factor C is at level k. The cell means model is:

$$Y_{ijkm} = \mu_{ijk} + \varepsilon_{ijkm}, m = 1, \ldots, n, k = 1, \ldots, c, j = 1, \ldots, b, i = 1, \ldots, a$$

Where ε_{ijkm} are independent $N\left(0, \sigma^2\right)$, and μ_{ijk}'s are the means. Note that the total number of observations is equal to $n_T = nabc$. The main effects and the interactions were: main effect of factor A, main effect of factor B, main effect of factor C, interaction between A and B, interaction between A and C, interaction between B and C, and three factor interaction between A, B and C.

F-test and ANOVA tables are used to analyze whether main effects or interaction between factors exist. The following table presents the null and alternative hypothesis for various tests, the corresponding F-statistics and the degrees of freedom associated with these F-tests. α_i, β_j, $(\alpha\beta)_{ij}$, $(\alpha\gamma)_{ik}$, $(\beta\gamma)_{jk}$

and $(\alpha\beta\gamma)_{jk}$ are coefficients of the main effects or interaction listed above, and MSA, MSB, MSC... are all mean squares. Detailed F-test table related to three-factor analysis is shown in Figure 1.

Null	Alternative	F-statistic
$\alpha_i = 0$ for all i	not all α_i's are zero	$F^* = \frac{MSA}{MSE}$
$\beta_j = 0$ for all j	not all β_j's are zero	$F^* = \frac{MSB}{MSE}$
$(\alpha\beta)_{ij} = 0$ for all i and j	not all $(\alpha\beta)_{ij}$'s are zero	$F^* = \frac{MSAB}{MSE}$
$(\alpha\gamma)_{ik} = 0$ for all i and k	not all $(\alpha\gamma)_{ij}$'s are zero	$F^* = \frac{MSAC}{MSE}$
$(\beta\gamma)_{jk} = 0$ for all j and k	not all $(\beta\gamma)_{jk}$'s are zero	$F^* = \frac{MSBC}{MSE}$
$(\alpha\beta\gamma)_{jk} = 0$ for all i, j and k	not all $(\alpha\beta\gamma)_{ijk}$'s are zero	$F^* = \frac{MSABC}{MSE}$

***Figure 1.** F-test table.*

In this report, a three-factor analysis on variable learning achievement in reading (upper secondary) was performed. The data was focused on year 2015 and level 4, and three factors gender, location and wealth were chosen to figure out the effect of each factor and interaction on the response variable. Factor gender had 2 levels: female and male; factor location had 2 levels: rural and urban; and the factor wealth had 5 levels: richest, rich, middle, poor, and poorest; and there were 2 observations for each of the combinations of three factors. Several diagnostic plots along with the interaction plot were drawn, and an ANOVA table was also generated to evaluate the model.

2.2.2. Longitudinal Analysis

Longitudinal data analysis [9-10] is related to repeated measure design. It often involves repeated observations of the same variables over short or long periods of time. There is also a covariate variable X. The idea is to see how observations vary over time in the existence of covariate.

In this report, the setting was: learning achievement in reading (upper secondary) in Canada was the response variable, and there were $S = 28$ data entries based on different disparities. For each data entry, a response was measured at each of r_i time points, which were the years 2003, 2006, 2009, 2012, and 2015. The covariate variable X was the level and X had 4 levels: low proficiency, minimum proficiency, medium proficiency and high proficiency. Thus three reasonable models related to repeated measures designs were introduced. In all of the models, ρ_i's were random subject effect with ρ_i's iid $N\left(0, \sigma_\rho^2\right)$, τ_j's were year factor effects, and ε_{ij}'s iid $N\left(0, \sigma^2\right)$. Three models for the response variables were:

(i) $Y_{ij} = \mu + \rho_i + \tau_j + \varepsilon_{ij}, \sum \tau_j = 0$. Covariate variable was not included in this model. This was a repeated measures model.

(ii) $Y_{ij} = \mu + \rho_i + \tau_j + \beta_1 X_i + \varepsilon_{ij}$, it was same as model (i), but the covariate variable X_i was included. This was a repeated measures model with covariate.

(iii) $Y_{ij} = \mu + \rho_i + \tau_j + \beta_1 X_i + \beta_2 \tau_j X_i + \varepsilon_{ij}$, This was a repeated measures model with covariate and interaction between year and covariate.

In order to select among these models, a choice to choose the one with the smallest Akaike Information Criterion (AIC) value was made. AIC is a measure for model quality and is used in model selection. AIC value of the model is the following: $\text{AIC} = 2k - 2\ln(\hat{L})$ where k is the number of estimated parameters and $\hat{L}$ is the maximum value of the likelihood function for the model. Several diagnostic plots were also drawn to do the model evaluation.

3. Results

3.1. Worldwide: Upper Secondary Completion Rate

From Figure 1 and Figure 2 one could see that among all areas in the world, females aged between 20-29 in Eastern and South-eastern Asia, Latin America and the Caribbean, and Europe and Northern America had higher upper secondary completion rates than males. Females aged between 20-29 also had a higher upper secondary completion rate than males in upper middle income countries and high income countries. People aged between 20-29 in urban areas always had a higher upper secondary completion rate than people in rural areas no matter the areas and incomes of their countries. Not only that but people aged between 20-29 in rich families always had a higher upper secondary completion rate than people in poor families no matter the areas and incomes of their countries. Difference in other disparities such as region, ethnicity, and religion can be found on the WIDE website.

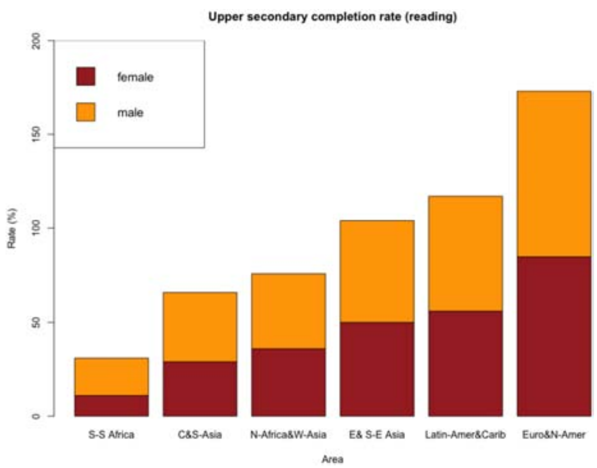

***Figure 2.** Stacked Barplot of upper secondary completion rate based on area and gender.*

Among all areas, people aged between 20 and 29 in Europe and Northern America had a higher upper secondary completion rate than people in other areas. Also, males always had a higher upper secondary completion rate than females no matter what area they belonged to.

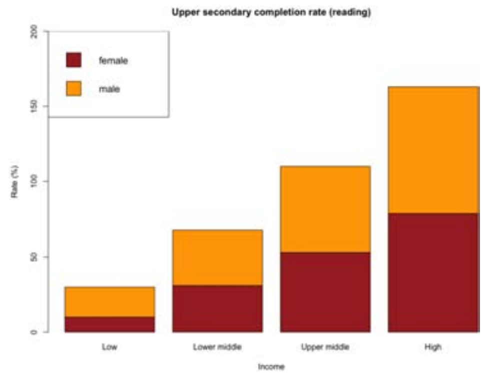

Figure 3. Stacked Barplot of upper secondary completion rate based on income and gender.

Among all countries, people aged between 20 and 29 in high income countries had a higher upper secondary completion rate than people in upper middle, lower middle, and low income countries. Also, males always had a higher upper secondary completion rate than females no matter whether their countries were rich or not.

3.2. Canada: Learning Achievement in Reading (Upper Secondary)

3.2.1. Three-factor Analysis

Figure 4 showed an interaction plot of three factors: gender, location and wealth about learning achievement in reading (upper secondary, year 2015, level 4) in Canada. In poor families, differences between rural and urban areas in reading were almost the same in both females and males. However, in other wealth level families, differences between rural and urban areas in reading of females were larger than that in males.

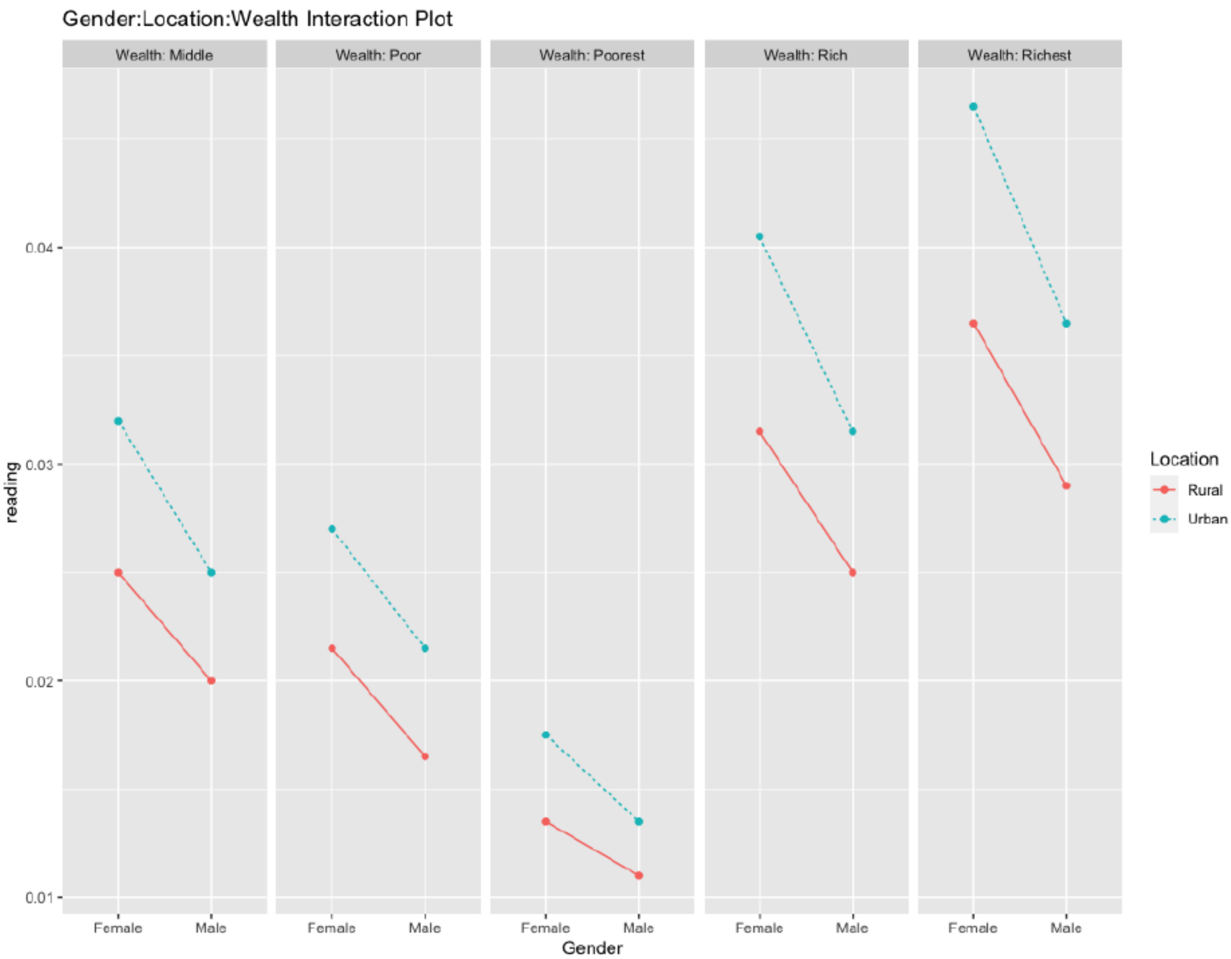

Figure 4. Interaction plot among gender, location and wealth.

Next, in order to do three-factor analysis, a full model was built as:
reading = gender+location+wealth+gender*location+gender*wealth+location*wealth+gender*location*wealth

According to the R output, the adjusted R-squared was 0.9756. The ANOVA table of full model showed that all three main effects are significant. From diagnostic plots of full model, the pattern in Q-Q plot and distribution of residuals showed that the full model did not prove normality and an equal variance assumption. Therefore, a reduced model was needed as: reading = gender+location+wealth. Details of the full model and the reduced model can be seen in Appendix (Figures 1-6).

In conclusion, the effects of three factors: gender, location and wealth along with their interaction on the response variable Learning achievement in reading (upper secondary) were studied. The reduced model proved that there were significant effects of these three factors. Therefore, when considering inequity in education in Canada, a focus on the disparities between females and males, between people in rural and urban areas, and between people in rich and poor families was needed. It is the government's responsibility to provide more opportunities for people coming from rural areas and poor families and to promote equity of education in gender.

3.2.2. Longitudinal Analysis

Figure 5 (left) showed a line chart of learning achievement in reading (upper secondary) over year by level 4: high proficiency. From the plot one could see there was no significant difference in learning achievement as time went. Figure 5 (right) showed a line chart of learning achievement in reading (upper secondary) over level by year 2015. From the plot one could see there was significant difference in learning achievement by levels. People had higher reading achievement as level increased.

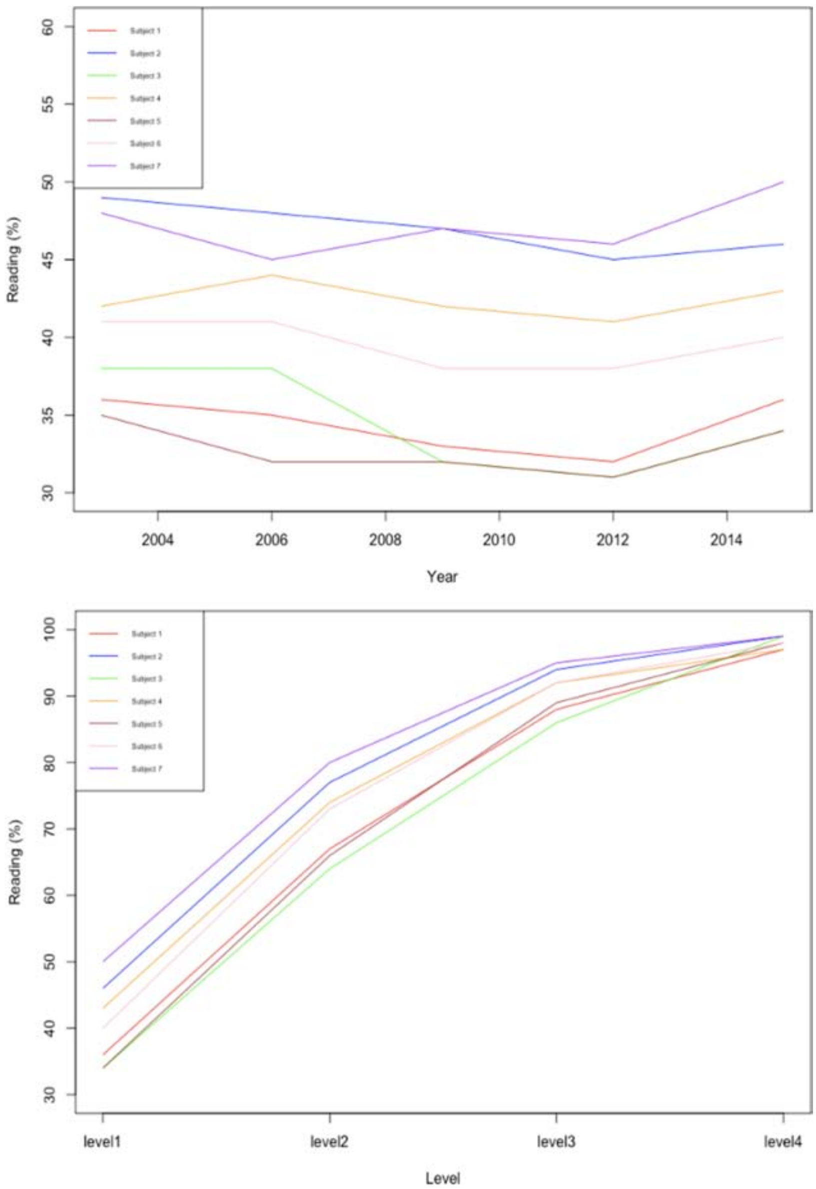

Figure 5. *(left): Line charts of learning achievement in reading (upper secondary) over year by level 4. Each line represented one subject. For each level, there were 7 subjects; (right): Line charts of learning achievement in reading (upper secondary) over level by year 2015. Each line represented one subject. For each year, there were 7 subjects.*

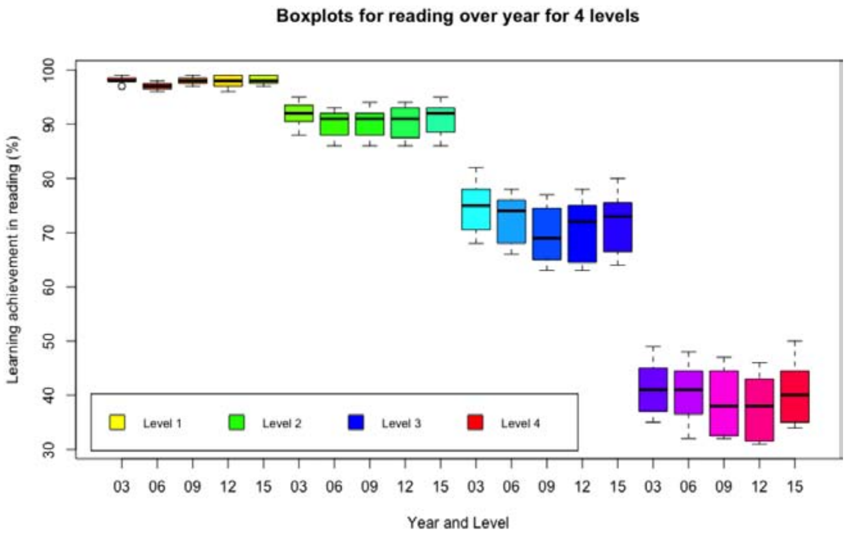

Figure 6. *Boxplot of learning achievement in reading (upper secondary) over year and 4 levels.*

Figure 6 showed a boxplot of learning achievement in reading (upper secondary) over year for 4 levels in Canada. From left to right were boxplots for level 1 to 4 over years. One could see that in level 1, the learning achievement in reading was the highest. The learning rate in reading decreased as the level increased, but there was no significant difference over years within the same level. This pattern was consistent with what in Figure 5.

Then three models related to repeated measures were built to do the comparison. The model with smallest AIC value was chosen to be final model, which was the model with AIC value 539.5. Diagnostic plots about this model could be seen in Appendix (Figure 7).

4. Discussion

Throughout this study, World Inequality Database on Education (WIDE) was used to study effects of major factors that play an important role on indicators of equity in education. Two stacked bar plots show that people aged between 20 and 29 in Europe and Northern America, and from high income countries, always enjoy higher upper secondary completion rates. Also, males always have a higher upper secondary completion rate than females no matter what area and income of their countries. Statistical analysis including three-factor and longitudinal analysis using learning achievement in reading (upper secondary) in Canada as response variable show that there are significant main effects of gender, location, wealth on the response variable, and observations of response variables vary among years with four different levels as covariate variables. Other disparity factors may also have an influence on the response variable. These demographic, socioeconomic, and parental/familial factors will highlight promising trends in our data.

When exploring the dataset, several further steps can be taken to extend this study. For example, when analyzing situations worldwide, more specific and typical countries can be selected, among which comparison can be made for those disparities such as gender and religion. Also, to better understand education in Canada, more indicators such as learning achievement in mathematics (upper secondary) and learning achievement in science (upper secondary) can be chosen and apply three-factor and longitudinal analysis. As reading is just one aspect in academia, incorporating both math and science will provide more thorough insights when our government forms and releases policies.

5. Conclusion

Education is an exceptionally major and basic theme to each nation. Throughout this study, the themes of education comparison with factors such as ethnicity, social status and gender were frequently used. This was essential in order to analyze the social gap between the issues and to find a education system with more equity. Our administration should assume the liability to advance value in schooling, giving equivalent occasions to understudies regardless of their sex, areas, nationalities, and so on. From our perspective, these above measurable discoveries and ends can fill in as long haul exhortations valuable for administrative arrangement plans. For instance, in Canada, contrasts in understanding execution (upper secondary) were critical between various sex, area, and abundance gatherings. This infers that there is still a long approach to understand the last value objective. Only taking actions in regards to educational opportunities is not enough as our government also need to tackle the problem of poverty and eliminate the gender discrimination.

Other measures our government may take include emphasizing on high level education, as students tend to perform worse as the level goes up. There should be very mature training and selection systems to promote public education and cultivate elite talents at the same time. Future research can be done by figuring out more significant factors regarding equity in education. Additionally, data from more countries and indicators can be explored to bring more novel findings.

Appendix

```
Call:
lm(formula = reading ~ Gender * Location * Wealth, data = data1)

Residuals:
    Min      1Q  Median      3Q     Max
-0.0015 -0.0010  0.0000  0.0010  0.0015

Coefficients:
                                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                              2.500e-02  1.049e-03  23.837 3.70e-16 ***
GenderMale                              -5.000e-03  1.483e-03  -3.371 0.003038 **
LocationUrban                            7.000e-03  1.483e-03   4.719 0.000131 ***
WealthPoor                              -3.500e-03  1.483e-03  -2.360 0.028566 *
WealthPoorest                           -1.150e-02  1.483e-03  -7.753 1.88e-07 ***
WealthRich                               6.500e-03  1.483e-03   4.382 0.000288 ***
WealthRichest                            1.150e-02  1.483e-03   7.753 1.88e-07 ***
GenderMale:LocationUrban                -2.000e-03  2.098e-03  -0.953 0.351738
GenderMale:WealthPoor                    1.971e-18  2.098e-03   0.000 1.000000
GenderMale:WealthPoorest                 2.500e-03  2.098e-03   1.192 0.247280
GenderMale:WealthRich                   -1.500e-03  2.098e-03  -0.715 0.482814
GenderMale:WealthRichest                -2.500e-03  2.098e-03  -1.192 0.247280
LocationUrban:WealthPoor                -1.500e-03  2.098e-03  -0.715 0.482814
LocationUrban:WealthPoorest             -3.000e-03  2.098e-03  -1.430 0.168099
LocationUrban:WealthRich                 2.000e-03  2.098e-03   0.953 0.351738
LocationUrban:WealthRichest              3.000e-03  2.098e-03   1.430 0.168099
GenderMale:LocationUrban:WealthPoor      1.500e-03  2.966e-03   0.506 0.618630
GenderMale:LocationUrban:WealthPoorest   5.000e-04  2.966e-03   0.169 0.867844
GenderMale:LocationUrban:WealthRich     -5.000e-04  2.966e-03  -0.169 0.867844
GenderMale:LocationUrban:WealthRichest  -5.000e-04  2.966e-03  -0.169 0.867844
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.001483 on 20 degrees of freedom
Multiple R-squared:  0.9875,    Adjusted R-squared:  0.9756
F-statistic: 83.11 on 19 and 20 DF,  p-value: 5.445e-15
```

Figure 7. *Summary of full model of three-factor analysis.*

```
> anova(model1)
Analysis of Variance Table

Response: reading
                       Df    Sum Sq    Mean Sq  F value    Pr(>F)
Gender                  1 0.0003844 0.00038440 174.7273 2.417e-11 ***
Location                1 0.0003844 0.00038440 174.7273 2.417e-11 ***
Wealth                  4 0.0026214 0.00065535 297.8864 < 2.2e-16 ***
Gender:Location         1 0.0000081 0.00000810   3.6818   0.06939 .
Gender:Wealth           4 0.0000371 0.00000928   4.2159   0.01232 *
Location:Wealth         4 0.0000371 0.00000928   4.2159   0.01232 *
Gender:Location:Wealth  4 0.0000014 0.00000035   0.1591   0.95653
Residuals              20 0.0000440 0.00000220
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 8. *ANOVA table of full model of three-factor analysis. From this table one could see that all three main effects were significant as they had p value less than 0.01. The interaction terms between either two factors or three factors were not significant as they all had p value greater than 0.01.*

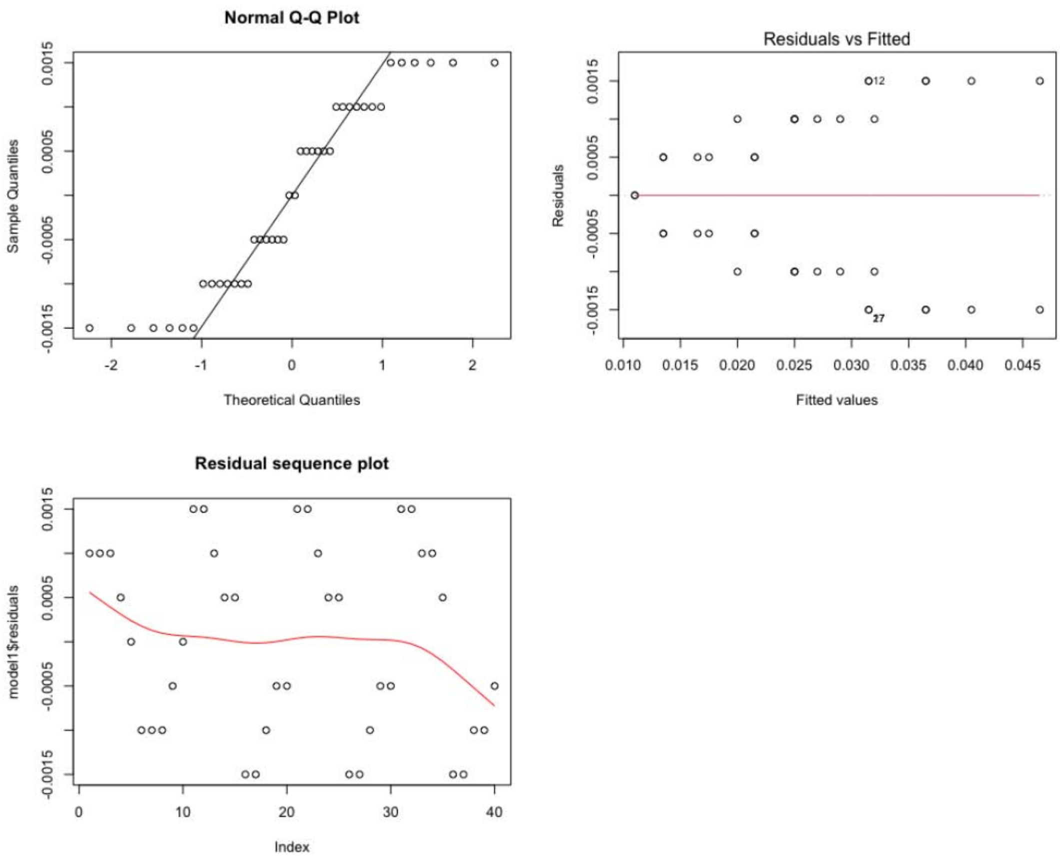

Figure 9. *Diagnostic plots of full model of three-factor analysis. From the pattern in Q-Q plot and distribution of residuals, this full model did not prove normality and equal variance assumption.*

```
Call:
lm(formula = reading ~ Gender + Location + Wealth, data = data1)

Residuals:
      Min        1Q    Median        3Q       Max
-0.003075 -0.001500  0.000125  0.000875  0.004675

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)     0.0255000  0.0008229  30.987  < 2e-16 ***
GenderMale     -0.0062000  0.0006221  -9.967 1.76e-11 ***
LocationUrban   0.0062000  0.0006221   9.967 1.76e-11 ***
WealthPoor     -0.0038750  0.0009836  -3.940 0.000399 ***
WealthPoorest  -0.0116250  0.0009836 -11.819 2.10e-13 ***
WealthRich      0.0066250  0.0009836   6.736 1.13e-07 ***
WealthRichest   0.0116250  0.0009836  11.819 2.10e-13 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.001967 on 33 degrees of freedom
Multiple R-squared:  0.9637,    Adjusted R-squared:  0.9571
F-statistic:   146 on 6 and 33 DF,  p-value: < 2.2e-16
```

Figure 10. *Summary of reduced model of three-factor analysis.*

```
> anova(model2)
Analysis of Variance Table

Response: reading
          Df    Sum Sq    Mean Sq F value    Pr(>F)
Gender     1 0.0003844 0.00038440  99.336  1.76e-11 ***
Location   1 0.0003844 0.00038440  99.336  1.76e-11 ***
Wealth     4 0.0026214 0.00065535 169.354 < 2.2e-16 ***
Residuals 33 0.0001277 0.00000387
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 11. *ANOVA table of reduced model of three-factor analysis. From this table one could see that all three main effects were significant as they had p value less than 0.01.*

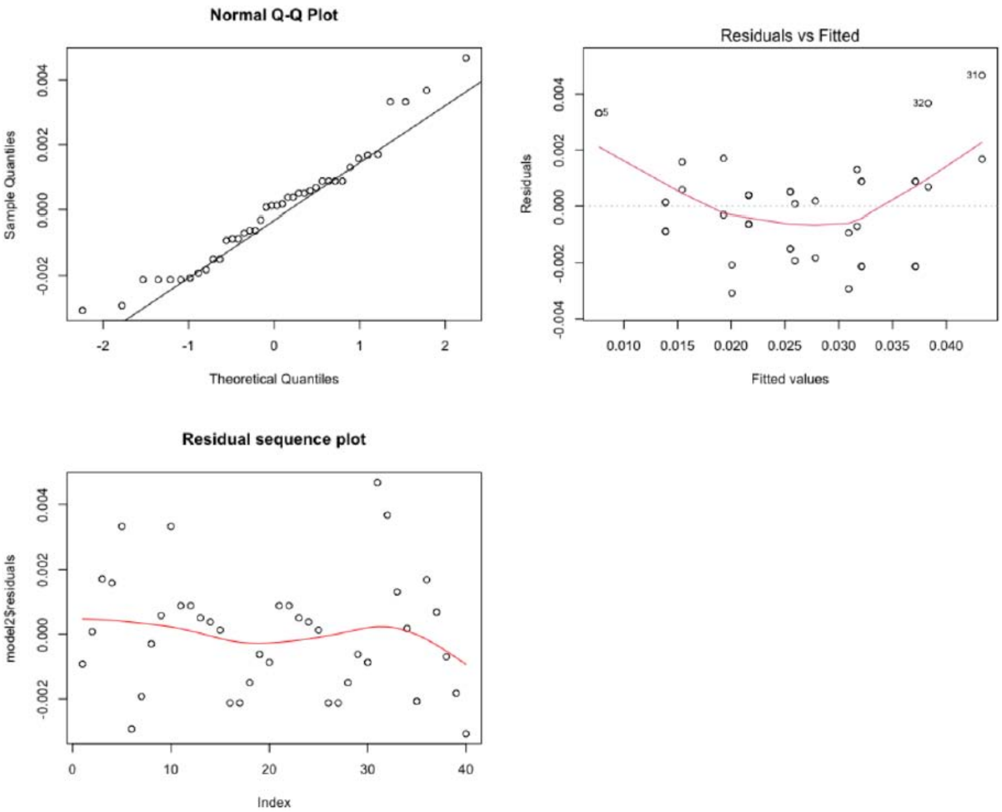

__Figure 12.__ Diagnostic plots of reduced model of three-factor analysis. From the pattern in Q-Q plot and distribution of residuals, this reduced model proved normality and equal variance assumption. Then, this could be final model.

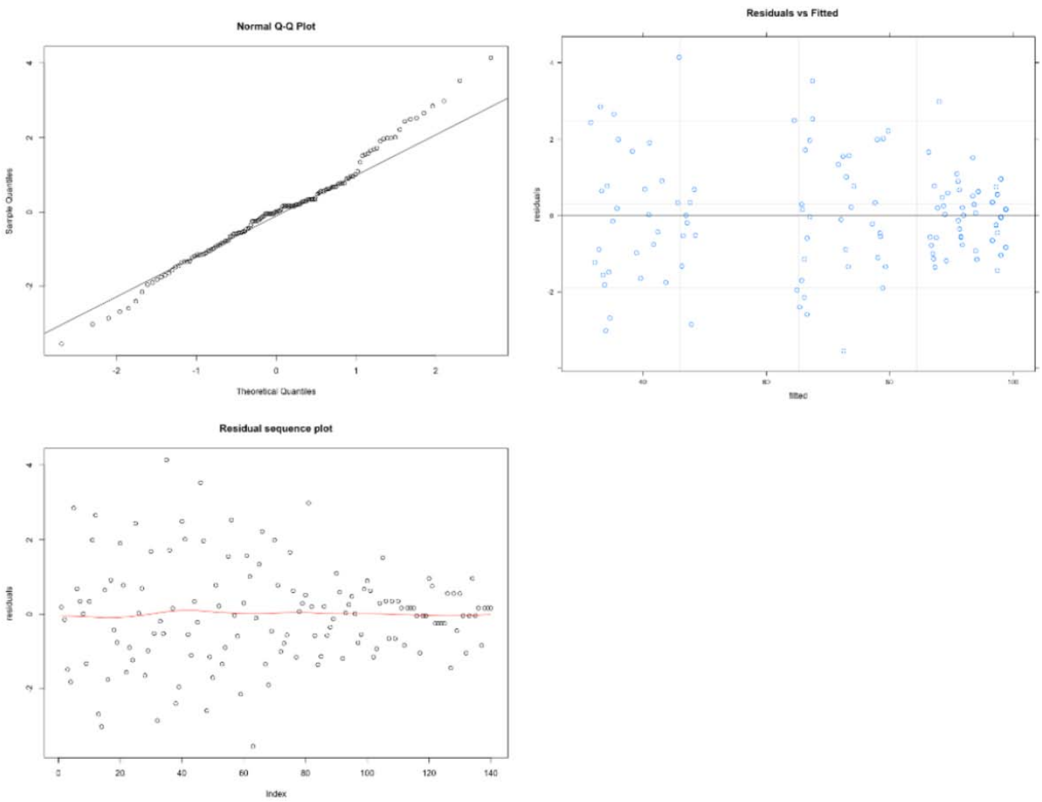

__Figure 13.__ Diagnostic plots of the model with AIC value 539.5 in longitudinal analysis. From the pattern in Q-Q plot and distribution of residuals, this full model proves normality and equal variance assumption. Then we can call this final model.

References

[1] UNESCO. (2013). Education for All Global Monitoring Report Teaching and Learning for Development. http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/gmr2013-thematic-notev2.pdf

[2] Valiente, O. and Lee, M. (2020). Exploring the OECD survey of adult skills (PIAAC): implications for comparative education research and policy. *Compare: A Journal of Comparative and International Education.* 50 (2), 155-164.

[3] Hopfenbeck, T. N., Lenkeit, J., Masri, Y. E., et al. (2018). Lessons Learned from PISA: A Systematic Review of Peer-Reviewed Articles on the Programme for International Student Assessment. *Scandinavian Journal of Educational Research.* 62 (3), 333-353.

[4] Felouzis, G. and Charmillot, S. (2013). School tracking and educational inequality: a comparison of 12 education systems in Switzerland. *Comparative Education.* 49 (2), 181-205.

[5] Glaesser, J. and Cooper, B. (2012). Educational achievement in selective and comprehensive local education authorities: a configurational analysis. *British Journal of Sociology of Education.* 33 (2), 223-244.

[6] Ewijk, R. V. and Sleegers, P. (2010). Peer ethnicity and achievement: a meta-analysis into the compositional effect. *School Effectiveness and School Improvement.* 21 (3), 237-265.

[7] Tucker, L. R. (1966). Some mathematical notes on three-mode factor analysis. *Psychometrika volume.* 31, 279-311.

[8] Kline, P. (2014). An Easy Guide to Factor Analysis. *Psychology.*, Chapters 1.

[9] Ruspini, E. (2003). An Introduction to Longitudinal Research. *Social Science.*, Chapters 1, 2, 3, 4, 5.

[10] Diggle, P., Heagerty, P., Liang, K. Y. and Zeger, S. (2013). Elisabetta Ruspini Analysis of Longitudinal Data. *Mathematics.*, Chapters 1, 2, 3, 4, 5.

[11] Carolina, F., Barbara, F. (2018). Women in Academia and Research: An Overview of the Challenges Toward Gender Equality in Colombia and How to Move Forward. *Frontiers in Astronomy and Space Sciences.*

[12] Carlo, B. (2011). Some Things Never Change: Gender Segregation in Higher Education across Eight Nations and Three Decades. *Sociology of Education.* 84 (2), 157-176.

[13] Breen, R., Heath, A., Whelan, C. (1999). Educational Inequality in Ireland, North and South. *Proceedings of the British Academy.* 98, 187-214.

[14] Julie, A., Sue, G. (2018). Teaching Mathematics to Lower Attainers: Dilemmas and Discourses. *Research in Mathematics Education.* 20 (1), 53-69.

[15] Chris, S. (1991). Educating the Body: Physical Capital and the Production of Social Inequalities. *Sociology.* 25 (4), 653-672.