

Analysis Report

This report is structured as follow.

Contents

Reliability Tests	2
Cross-Tabulations	2
Two-way ANOVA	5
The effect of being an immigrant and having a room of their own on the score of Mathematics	6
The effect of being an immigrant and speaking a foreign language on the score of Mathematics	8
The effect of being an immigrant and having support from the parents on the score of Mathematics	9
The effect of being an immigrant and receiving help from the parents on the score of Mathematics	10
References	13

Reliability Tests

In order to have a single score for mathematics, science and reading, the 10 plausible values of each scale were averaged and the reliability of the resulting scales was calculated. Reliability is an assessment of the degree of consistency between multiple measurements of a variable. One form of reliability is test–retest, by which consistency is measured between the responses for an individual at two points in time. The objective is to ensure that responses are not too varied across time periods so that a measurement taken at any point in time is reliable. A second and more commonly used measure of reliability is internal consistency, which applies to the consistency among the variables in a summated or averaged scale. The rationale for internal consistency is that the individual items or indicators of the scale should all be measuring the same construct and thus be highly intercorrelated (Hair et al., 2014). The analysis in this study was done using Cronbach’s Alpha.

The reliability of the scores was very good for mathematics ($\lambda = .975$), science ($\lambda = .980$) and reading ($\lambda = .991$).

Cross-Tabulations

This section is dedicated to present the comparison of immigrants and non-immigrants with respect to the variables of interest. The first table presents the different frequencies of responses for the categorical variables among those two conditions. The table also contains the results of a chi-square test. The chi-square test evaluates if the differences in these proportions of responses are significantly different for each group under analysis.

If the p-value is below 0.05, it means that there is a statistically significant effect of being an immigrant and responding in a certain way, with a 95% confidence level. Cramer’s V is a measure of effect size and it can be interpreted as the following: coefficients near 0.10 indicate a small effect, whereas 0.30 can be interpreted as medium effect and 0.50 large effect (Cohen, 1988). Effect sizes should only be interpreted, however, if the test is significant (Sig. less than 0.05). The tables below shows the results.

		In what country were you and your parents born? You						Chi-Square	p	Cramer's V
		Country of test		Other country		Subtotal				
		Count	%	Count	%	Count	%			
In your home: A room of your own	Yes	28395	89.14%	2645	81.54%	31040	88.44%	165.981	< .001	0.069
	No	3458	10.86%	599	18.46%	4057	11.56%			
How many in your home: Televisions	None	88	0.28%	32	0.99%	120	0.34%	400.536	< .001	0.111
	One	3965	12.47%	711	21.93%	4676	13.35%			
	Two	9903	31.15%	1221	37.66%	11124	31.75%			
	Three or more	17838	56.10%	1278	39.42%	19116	54.56%			
How many in your home: Rooms with a bath or shower	None	552	1.75%	77	2.41%	629	1.81%	696.193	< .001	0.142
	One	7674	24.38%	1448	45.28%	9122	26.31%			
	Two	16754	53.23%	1303	40.74%	18057	52.08%			
	Three or more	6496	20.64%	370	11.57%	6866	19.80%			
How many books are there in your home?	0-10 books	2567	8.08%	787	24.38%	3354	9.59%	1483.97	< .001	0.206
	11-25 books	4347	13.69%	827	25.62%	5174	14.79%			
	26-100 books	10216	32.17%	884	27.39%	11100	31.72%			
	101-200 books	6872	21.64%	356	11.03%	7228	20.66%			
	201-500 books	5267	16.58%	240	7.43%	5507	15.74%			
	More than 500 books	2492	7.85%	134	4.15%	2626	7.51%			
What language do you speak at home most of the time?	Language of the test	27840	87.38%	2001	61.59%	29841	84.99%	1535.066	< .001	0.209
	Other language	4022	12.62%	1248	38.41%	5270	15.01%			
Thinking about <this academic year>: My parents support my educational efforts and achievements.	Strongly disagree	1108	4.32%	155	6.15%	1263	4.49%	88.031	< .001	0.056
	Disagree	1825	7.12%	231	9.16%	2056	7.30%			
	Agree	9071	35.39%	1031	40.90%	10102	35.89%			
	Strongly agree	13625	53.16%	1104	43.79%	14729	52.32%			
Thinking about your parents or guardians, how often do they: Help me as much as I need	Almost never	1523	6.24%	209	9.28%	1732	6.50%	206.888	< .001	0.088
	Sometimes	6646	27.24%	885	39.28%	7531	28.26%			
	Almost always	16229	66.52%	1159	51.44%	17388	65.24%			

All the differences between immigrants and non-immigrants are statistically significant ($p < .001$). For example, having a room of their own is significantly less frequent for immigrants (81.54%) compared to non-immigrants (89.14%). Strongly agreeing that the parents support the educational achievements is significantly less frequent for immigrants

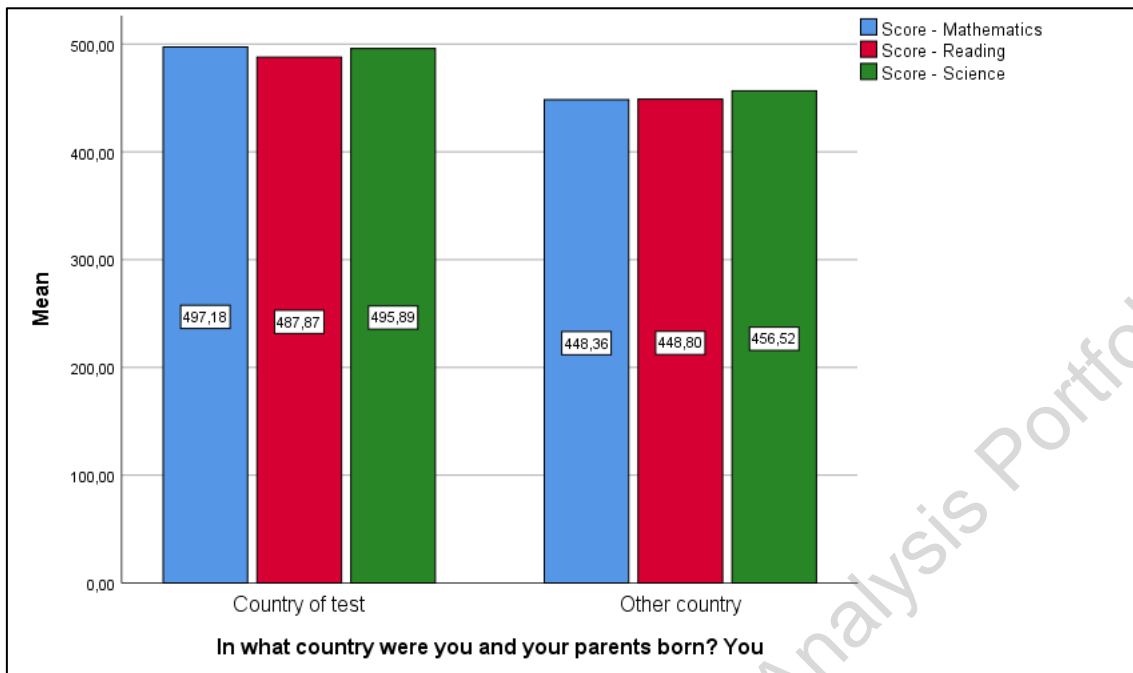
(43.79% against 53.16% for non-immigrants). Receiving help from the parents almost always is significantly more frequent for non-immigrants (66.52% against 51.44%).

Next, the differences on the overall scores for mathematics, science and reading were evaluated. The results are shown in the table below along with the results of T-tests. Independent Samples T-tests are appropriate when comparing the scores of a continuous variable between two different groups (Hair et al., 2014).

A Levene's test (Levene, 1961) was conducted to examine homogeneity of variances. The test showed that variances were not homogeneous between groups with respect to all variables ($p < .05$). Thus, the results of the t-tests were extracted from the 'Equal Variances Not Assumed' line of the SPSS output.

	In what country were you and your parents born? You						t	p
	Country of test		Other country		Subtotal			
	M	SD	M	SD	M	SD		
Score - Mathematics	497.185	77.046	448.361	79.039	492.667	78.517	33.639	< .001
Score - Reading	487.866	86.368	448.801	89.421	484.251	87.390	23.81	< .001
Score - Science	495.890	79.371	456.524	80.921	492.247	80.329	26.478	< .001

The table shows that the overall scores are significantly lower for the immigrants compared to the non-immigrants for the three scores ($p < .001$). The graph below illustrates these differences. The highest difference is observed in Mathematics.



Two-way ANOVA

This section is dedicated to present the effect of being an immigrant on the scores of mathematics and if this effect is different for different conditions. These tests were conducted using Analyses of Variance (ANOVAs). Analysis of variance is so called because it compares the variance (variability in scores) between the different groups (believed to be due to the independent variable) with the variability within each of the groups (believed to be due to chance). An F ratio is calculated, which represents the variance between the groups divided by the variance within the groups. A large F ratio indicates that there is more variability between the groups (caused by the independent variable) than there is within each group (referred to as the error term). A significant F test indicates that we can reject the null hypothesis, which states that the population means are equal. It does not, however, tell us which of the groups differ. Post-hoc tests are conducted for this (Pallant, 2010). Two-way means that there are two independent variables, and between-groups indicates that different people are in each of the groups. This technique allows us to look at the individual and joint effect of two independent variables on one dependent variable. Not only 'main effects' for each independent variable are assessed in two-way ANOVAs, but also the 'interaction effect' between

independent variables (groups). An interaction effect occurs when the effect of one independent variable on the dependent variable depends on the level of a second independent variable. For example, in this case we may find that the influence of being an immigrant on the score of mathematics is different for those who have a room of their own in their houses compared to those who do not. (Pallant, 2010).

One of the assumptions that ANOVA models have is that variables' scores follow a normal distribution. It should be noted, however, that ANOVA has been shown to be quite robust for when the assumption of normality is violated (Hair et al., 2014). Nevertheless, significant departs from normality should be taken with care. One of the methods to examine normality is to look at values of skewness and kurtosis. Both values should remain between -1 and 1 to indicate normality. As can be seen in the table below, no values surpass this threshold, which indicates no substantial departs from normality.

Descriptive Statistics

	N	Mean	Std. Deviation	Skewness	Kurtosis
Score - Mathematics	35943	491.161	79.096	-0.242	-0.309
Score - Reading	35943	482.729	88.089	-0.214	-0.297
Score - Science	35943	490.741	80.883	-0.153	-0.399
Valid N (listwise)	35943				

The next sections present the results of different ANOVA models conducted for each condition under study.

The effect of being an immigrant and having a room of their own on the score of Mathematics

There was a significant main effect of being an immigrant on the score of mathematics, $F(1, 35097) = 727.129$, $p < .001$, $\eta^2 = .020$. The thresholds for partial eta squared are the following (Cohen, 1988): 0.01: small effect; 0.06: medium effect; 0.138: large effect. Thus the effect size of being an immigrant can be considered small. There was a significant main effect of having a room of their own, $F(1, 35097) = 53.362$, $p < .001$, $\eta^2 = .002$. There was a significant interaction effect, $F(1, 35097) = 30287.796$, $p = .024$, η^2

< .001. This means that the effect of being an immigrant on mathematics is significantly different between those who have a room of their own and those who do not.

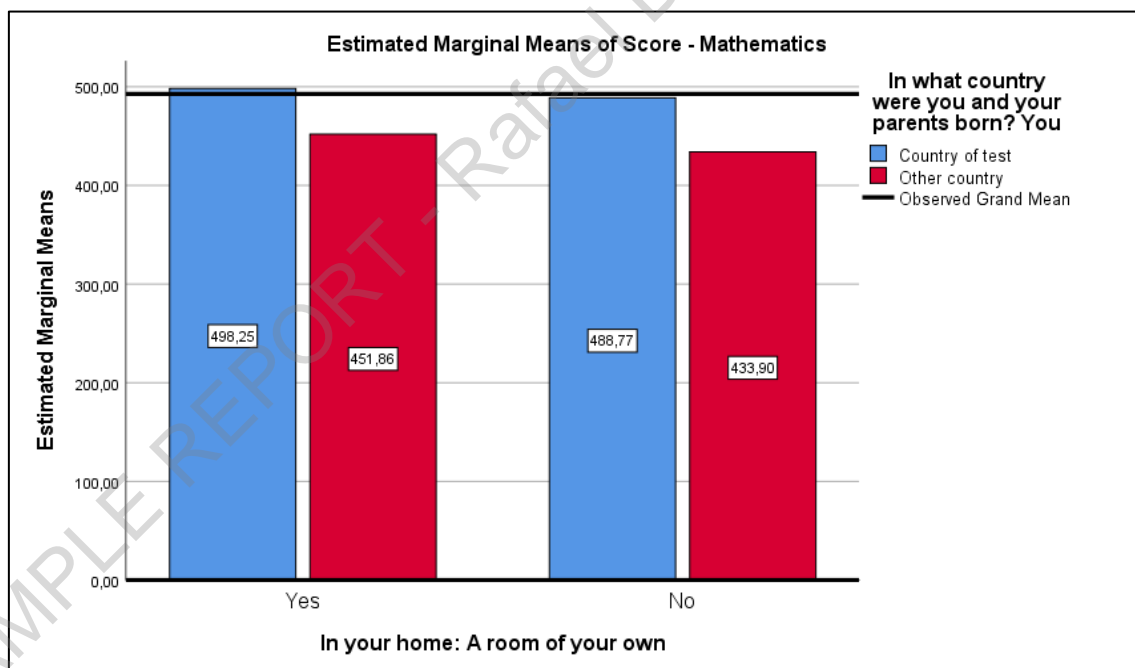
Tests of Between-Subjects Effects

Dependent Variable: Score - Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7410553,647 ^a	3	2470184.549	415.504	0.000	0.034
Intercept	1.48E+09	1	1478676269.328	248724.924	0.000	0.876
ST019AQ01T	4.32E+06	1	4322802.160	727.129	0.000	0.020
ST011Q02TA	3.17E+05	1	317241.086	53.362	0.000	0.002
ST019AQ01T *	3.03E+04	1	30287.796	5.095	0.024	0.000
ST011Q02TA						
Error	2.09E+08	35093	5945.027			
Total	8.74E+09	35097				
Corrected Total	2.16E+08	35096				

a. R Squared = ,034 (Adjusted R Squared = ,034)

In order to illustrate where these differences reside, the following graph was created.



Immigrants show a lower score in Mathematics. The difference in scores between immigrants and nn-immigrants is larger for those who do not have a room of their own. The black horizontal line on the graph shows the global mean score.

The effect of being an immigrant and speaking a foreign language on the score of Mathematics

There was a significant main effect of being an immigrant on the score of mathematics, $F(1, 34674) = 280.998$, $p < .001$, $\eta^2 = .008$. There was a significant main effect of speaking a foreign language, $F(1, 34674) = 108.234$, $p < .001$, $\eta^2 = .009$. There was no significant interaction effect, $F(1, 34674) = 30287.796$, $p = .053$, $\eta^2 < .001$. This means that the impact of being an immigrant is constant across different language contexts.

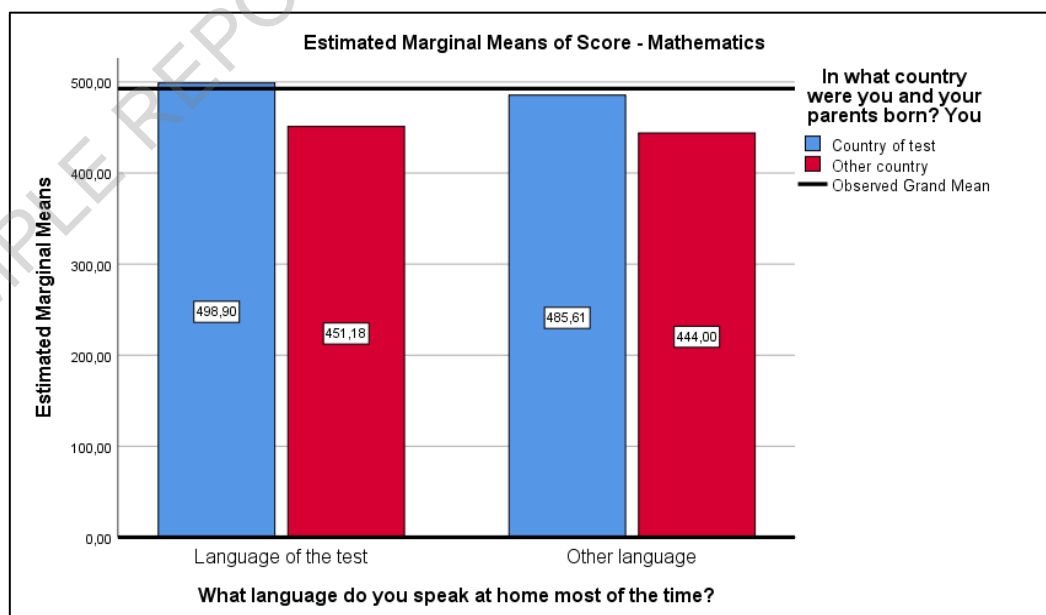
Tests of Between-Subjects Effects

Dependent Variable: Score - Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12677227,751 ^a	7	1811032.536	312.884	0.000	0.059
Intercept	7.39E+08	1	739021281.541	127677.403	0.000	0.786
ST019AQ01T	1.63E+06	1	1626471.443	280.998	0.000	0.008
ST012Q03TA	1.88E+06	3	626479.368	108.234	0.000	0.009
ST019AQ01T * ST012Q03TA	4.45E+04	3	14849.219	2.565	0.053	0.000
Error	2.01E+08	34666	5788.192			
Total	8.64E+09	34674				
Corrected Total	2.13E+08	34673				

a. R Squared = ,059 (Adjusted R Squared = ,059)

The figure below illustrates the differences.



The effect of being an immigrant and having support from the parents on the score of Mathematics

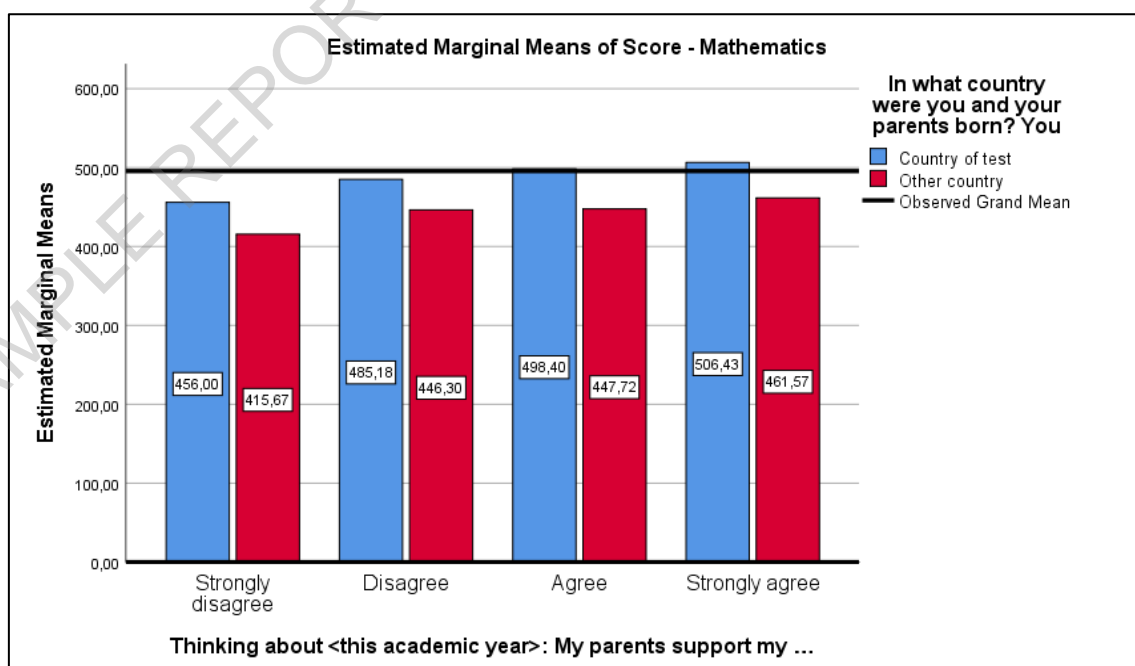
There was a significant main effect of being an immigrant on the score of mathematics, $F(1, 28150) = 372.207, p < .001, \eta^2 = .013$. There was a significant main effect of having support from the parents, $F(1, 34674) = 72.524, p < .001, \eta^2 = .008$. There was no significant interaction effect, $F(1, 34674) = 2.089, p = .099, \eta^2 < .001$. This means that the impact of being an immigrant is constant across those who receive parental support or not.

Tests of Between-Subjects Effects

Dependent Variable: Score - Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8797350,292 ^a	7	1256764.327	218.894	0.000	0.052
Intercept	9.67E+08	1	966944018.631	168415.225	0.000	0.857
ST019AQ01T	2.14E+06	1	2137000.214	372.207	0.000	0.013
ST123Q02NA	1.25E+06	3	416391.418	72.524	0.000	0.008
ST019AQ01T *	3.60E+04	3	11993.418	2.089	0.099	0.000
ST123Q02NA						
Error	1.62E+08	28142	5741.429			
Total	7.08E+09	28150				
Corrected Total	1.70E+08	28149				

a. R Squared = ,052 (Adjusted R Squared = ,051)



The figure above shows that the mean scores increase for those who agree that they receive support from the parents. This increase, however, is fairly similar between immigrants and non-immigrants.

The effect of being an immigrant and receiving help from the parents on the score of Mathematics

There was a significant main effect of being an immigrant on the score of mathematics, $F(1, 26651) = 363.818$, $p < .001$, $\eta^2 = .013$. There was a significant main effect of receiving help from the parents, $F(1, 26651) = 82.553$, $p < .001$, $\eta^2 = .008$. There was no significant interaction effect, $F(1, 26651) = 1.152$, $p = .316$, $\eta^2 < .001$. This means that the impact of being an immigrant is constant across those who receive help or not.

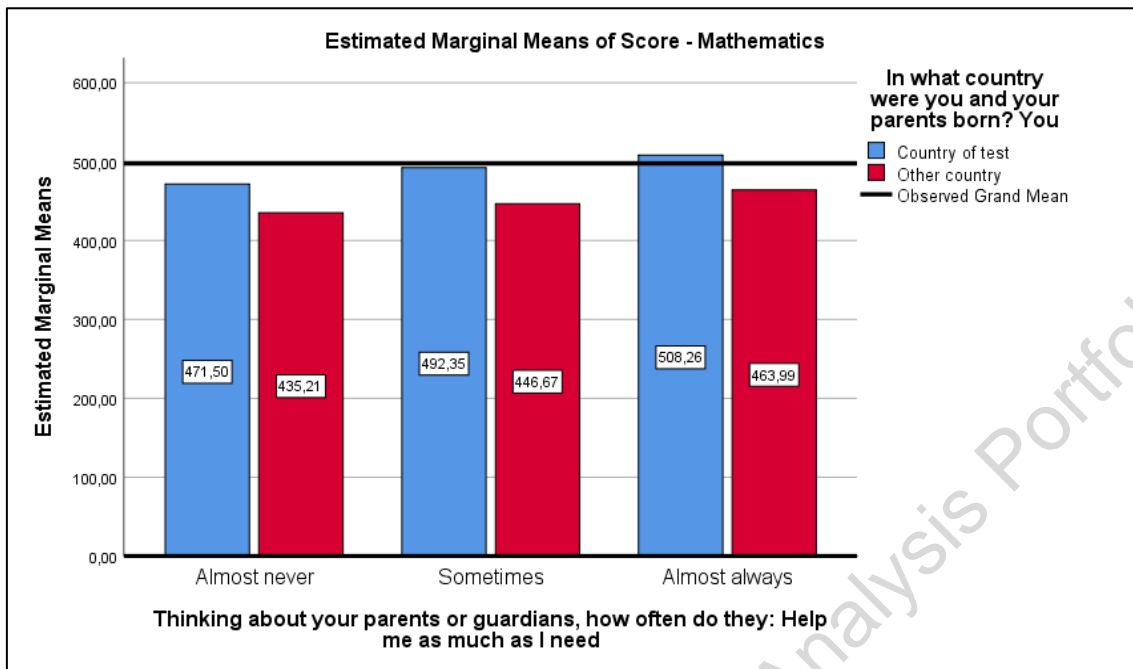
Tests of Between-Subjects Effects

Dependent Variable: Score - Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7481680,591 ^a	5	1496336.118	261.183	0.000	0.047
Intercept	1.04E+09	1	1038571520.633	181280.610	0.000	0.872
ST019AQ01T	2.08E+06	1	2084343.078	363.818	0.000	0.013
WB163Q01HA	9.46E+05	2	472955.334	82.553	0.000	0.006
ST019AQ01T *	1.32E+04	2	6598.835	1.152	0.316	0.000
WB163Q01HA						
Error	1.53E+08	26645	5729.082			
Total	6.76E+09	26651				
Corrected Total	1.60E+08	26650				

a. R Squared = ,047 (Adjusted R Squared = ,047)

The same patters observed in the previous analysis is repeated here, as can be seen in the graph below.



The effect of being an immigrant and the number of books in the home on the score of Mathematics

There was a significant main effect of being an immigrant on the score of mathematics, $F(1, 34988) = 325.301, p < .001, \eta^2 = .009$. There was a significant main effect of number of books on the score of mathematics, $F(1, 34988) = 464.184, p < .001, \eta^2 = .062$. There was a significant interaction effect, $F(1, 34988) = 7.173, p < .001, \eta^2 = .001$. This means that the impact of being an immigrant depends on the number of books the participant owns

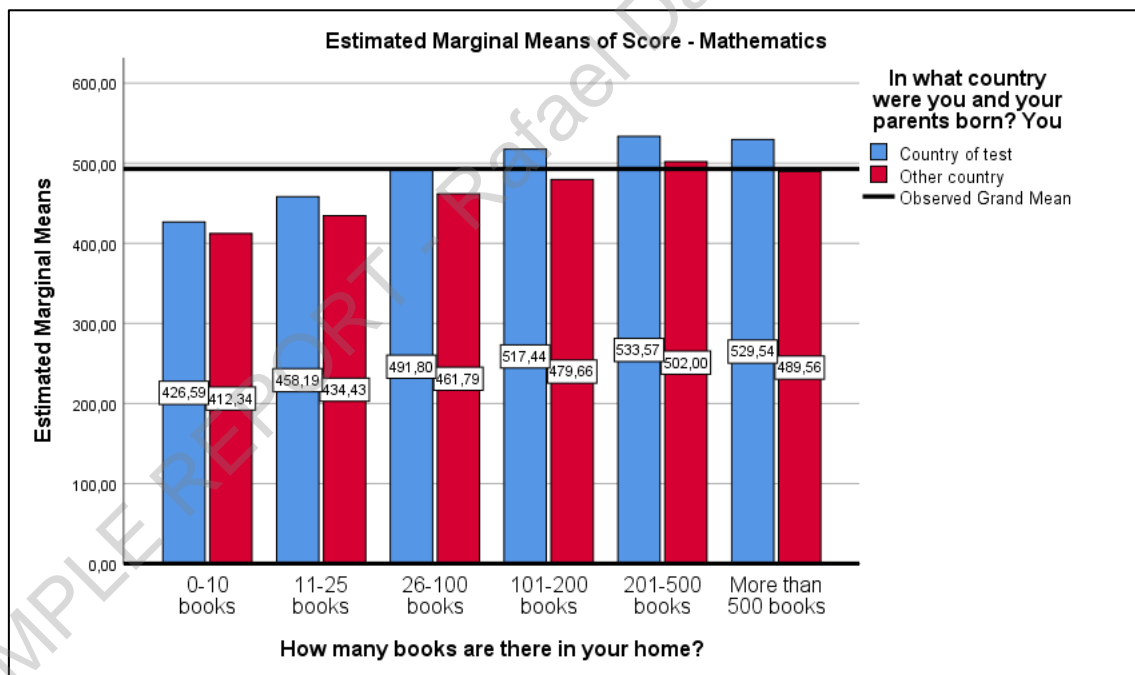
Tests of Between-Subjects Effects
Dependent Variable: Score - Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	41608604.811 ^a	11	3782600.437	762.952	0.000	0.194
Intercept	1687486728.520	1	1687486728.520	340366.683	0.000	0.907
ST019AQ01T	1612792.175	1	1612792.175	325.301	0.000	0.009
ST013Q01TA	11506769.675	5	2301353.935	464.184	0.000	0.062
ST019AQ01T * ST013Q01TA	177811.893	5	35562.379	7.173	0.000	0.001
Error	173410695.745	34977	4957.849			

Total	8715165197.683	34989
Corrected Total	215019300.555	34988
a. R Squared = 0.194 (Adjusted R Squared = 0.193)		

The figure below shows that the estimated marginal means of the score of mathematics increase as the scale of number of books increases. The figure also indicates that the difference on the score between immigrants and non-immigrants is lower for those who have 10 books or less, compared to those who have a higher number of books. That is, the discrepancy increases as the number of books owned increases. This might be an indication that the effect of having more books is more positive for non-immigrants than for immigrants (this is supported by the significant interaction effect that was found).

The difference in the score of mathematics is low between those who own '201-500 books' and those who own more than 500 books.



References

Cohen, J., 1988. Statistical power analysis for the behavioral sciences, 2nd ed. Erlbaum, Hillsdale, NJ.

Hair, J.F., Black, W., Babin, B., Anderson, R., 2014. Multivariate data analysis, Seventh. ed. Pearson Education, Inc., Edinburgh.

Levene, H., 1961. Robust tests for equality of variances. Contrib. to Probab. Stat. Essays Honor Harold Hotell. 279–292.

Pallant, J., 2010. SPSS Survival Manual, 4th ed. McGraw-Hill, Berkshire, England.

SAMPLE REPORT - Rafael Data Analysis Portfolio