An Examination of International Drivers of Educational Achievement

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Abstract

In this paper I analyze the various factors that drive educational achievement across various countries using regression analysis. The causal model includes the variables which describe family background, learning resources, school characteristics, learning approaches, and class features to fully account for all of the features that contribute to educational achievement. The Programme for International Student Assessment (PISA) 2006 data is used to compare the individual factors in relation to the achievement scores in math and science through statistical regression analysis. The majority of the variables behave in a way that confirms the expected outcomes: characteristics such as having a history of education in the family or possession of the proper resources to be an effective student all have positive impacts on the PISA achievement scores in both subjects. This paper also analyzes the relationship of achievement in different countries relative to the U.S. and extracts the main drivers of education, which have the greatest impact on achievement scores relative to all of the variables included.

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The Impetus for the Examination of Educational Achievement

Educational achievement stands as the cornerstone of society as education forms the foundation upon which societies are built. Education develops future leaders and citizens, and it is one of the main public goods provided by governments across the world. Countries strive to maximize students' educational achievement with their own approaches to providing effective learning institutions. In order to ascertain the optimal strategy and method for education it is important to first determine the main drivers for student achievement. The analysis of the educational system and factors that contribute to achievement scores has the potential to single out key variables that tend to have positive or negative effects on academic performance. This could be used to better understand educational systems and the aspects which lead toward a more effective and optimal educational system.

There are a number of theories and conceptions about the optimal mix of factors and each country tries to shape its educational institutions to match the indicators they consider most important for driving academic performance. Does student achievement depend on family background, resources, time spent on a particular subject, school characteristics or on other variables? In principle student achievement scores should be a function of all of these variables as they all explain different contributing factors to an individual's performance on standardized examinations, which are used to measure a student's aptitude. Exploring this question on an international basis offers a rich mix of different educational structures that would provide a comprehensive representation of all the distinct forms of schools and approaches to the teaching method. Some systems tend to prefer a vocational approach such as Germany, which makes apprenticeships a core part of the educational process (Carey 42). Other educational systems prefer a broader approach that encompasses a variety of subjects and limits learning to the classroom.

In this paper I determine which mechanisms or features tend to drive high educational achievement results by performing data analysis and comparing the educational systems from a variety of countries. The nations included in this analysis are industrialized high earning countries and also mid to small sized countries. The mechanisms driving a student's performance can range from school structure to student background to class size and much more.

Many of the current studies compare a particular variable across different countries, to see which countries have the highest funding or teacher compensation, without clarifying a comparison between the variable and academic achievement. Other investigations simply look at the relative values of funding or resources using bar charts. However, some studies do examine the relation between a single outcome variable and educational performance. In my thesis I extend previous studies by performing a more generalized analysis that considers a variety of variables (indicators) in order to allow for possible multiple correlations or cross-correlations that can demonstrate a solid connection between academic performance and the chosen indicators. An in depth comparison of different educational systems using regression analysis uncovers these relations. The indicators reflect the particular systems of schooling and consist of variables like class size, curriculum emphasis, resources, socioeconomic backgrounds, and more. The strength of including all of these variables in a single model is that it will: 1) take into account the different factors that contribute to educational achievement; 2) compare the relative effects of the variables to determine which features of a student's educational environment make the greatest impact on improving performance on standardized educational achievement examinations; 3) either affirm or disprove commonly held relations about school characteristics and learning styles and their effect on academic achievement.

Productive educational systems have high student achievement in different areas such as reading, mathematics, and science, which are part of the core curriculum of learning institutions in every country and are the common areas of testing in the Programme for International Student Assessment (PISA). Intuitively, countries should favor deriving high educational achievement scores relative to their investment on education, which is measured by funds spent by the government for providing public education.

There is a variety of economic literature dealing with international comparisons of educational systems, student performance, and models looking at the effects of specific variables. The Organisation for Economic Cooperation and Development (OECD) provides a plethora of data and written analyses of their study called PISA. The OECD and PISA are the central resources for this paper for both raw numerical data on student achievement and the indicators for schools (class size, curriculum, hours spent studying), student characteristics and many other variables. PISA examines 15-year-old students and tests them on information that is believed to be essential for their future (OECD, *Assessing* 9). The PISA study covers all of the thirty OECD countries and about twenty-seven non-OECD countries (OECD, *Assessing* 10). This group of countries provides a wide variety of educational institutions and resource data upon which to perform in depth data analysis.

In addition to the established studies from OECD, there are some articles which further analyze the PISA findings. It is important to consult the work already completed by others to use a point of reference and upon which one can build and travel beyond. In the article "Educational performance or educational inequality: what can we learn from PISA about France and

England?" Doyle does a comparative analysis of France and England using the PISA results to see the effects of different indicators. Her work bears some resemblance to my paper as she regressed achievement scores against specific indicators for France and England to provide a comparison between the two countries. In a similar manner the article "Public policy and the effect of sibship size on educational achievement: A comparative study of 20 countries," Hyunjoon Park analyzes the effect of having siblings on academic performance and extends this model to public policy results. His findings consist of multiple regression analysis for which the majority of the variables are statistically significant, meaning the number of siblings does have an effect upon educational performance. Park utilizes a variety of robust methods and two-level hierarchical linear models. Lastly, Papanstaisou and Ferdig analyze the PISA data to examine the relationship between computers and its affects on math literacy (361). All of these papers focus upon the analysis of single variables such as socio-economic background, siblings, or computers. My model extends previous PISA analysis as the regression includes many independent variables for all kinds of characteristics.

This paper examines a wide variety of different characteristics ranging from family background to individual qualities to the institutional approaches and more in order to incorporate as many key factors as possible that drive educational achievement. The PISA 2006 Examination is the main data source from which I will extrapolate the relation of achievement scores in math and science to the key characteristics defined in the causal model. In addition to administering the exam, PISA also administers of questionnaires for the individual students and for the schools participating, which provides the majority of the indicators and characteristics included in the model.

Presenting the Methods Employed and Causal Model

The PISA 2006 data set comes from the PISA website, and the data includes both a Student Questionnaire and a School Questionnaire. These provide the analysis with both individual characteristics of the student and information about the school the student attends. All data used in my ordinary least squares (OLS) regression comes from the PISA 2006 data set, including all of the dependent and independent variables. In the complete data set there are 398,000 observations. Therefore the OLS regression analysis tends to produce highly significant results in both t-statistics and p-values due to the extremely large value of observations. T-statistics and p-values are statistical hypothesis testing quantities, which are used to determine if the extreme measure found in the regression is a real effect or just due to random probability. In this analysis p-values of 5% or less are considered statistically significant, which means the effect observed holds merit and is not due to random chance.

The variables in the model consist of dummy variables and multiple choice answers. In my model, variables of the form of yes/no questions are denoted with a 1 for yes and 0 for no. Multiple choice answers, on the other hand, have been converted to multiple dummy variables for each response. These dummy variables look at the effect relative to some omitted variable. Thus in the regression analysis of multiple choice questions, one of the choices is left out of the regression as the model is already fully specified by the other variables. This is important because we cannot simply leave the multiple choice answer as a linear relationship because one answer “2 or more” versus the choice “1” is not necessarily worth twice the other, since “2 or more” includes other responses besides the value of 2. The use of dummy variables in this case averts this problem by looking at the impact of a particular response and clearly viewing the trends across the choices.

In any regression analysis it is important to look at the coefficients as they explain the relationship between the particular independent variable and the dependent variable we want to draw a relationship to. Thus my dependent variable in all regressions is the particular achievement score of the student from math or science. PISA used a scaled scoring method to describe student achievement using a complex method and formulation of plausible values for the students' aptitude. The scaled score has a mean achievement score of 500 and a standard deviation of 100 (OECD, *Assessing* 16). In the data set, PISA reports five plausible values for each student for each subject, and in my model I take the average of those five plausible values in order to have one variable for student achievement in a particular subject area.

The data covers a wide variety of countries, which enables a truly international comparison and analysis of the question about what drives educational achievement. Included in the regression analysis of the data set there are twenty-nine OECD countries and twenty-four non-OECD countries. France, an OECD country, has not been included in this analysis due to the fact that they did not answer the School Questionnaire that accounts for about half of the indicators in our model; since it was missing an exorbitant amount of data, it was better not to include it. However, the countries that are included represent a wide variety of highly industrialized to moderately industrialized nations and a diverse group of educational institutions and approaches to learning.

The regression analysis uses beta or standardized coefficients to measure the effects of variables more accurately and determine their actual contributions to the regression. These standardized coefficients are especially useful when the variables in the model have different units, and they facilitate comparing the relative relationship of different independent variables to the dependent variable. Beta coefficients describe what the effect would be of a change in one variable by a standard deviation. For example, if we had a beta coefficient of 0.162 for an independent variable this would mean that if the variable were to increase by 1 standard deviation the dependent variable would increase by 0.162 standard deviations. Standardized coefficients cause the coefficients to have variances of 1 and this is especially useful as the variables vary in measure and size. The standard rule for interpreting beta coefficients in this paper will be to consider beta coefficients greater than or equal to 0.04 as having an important effect on the achievement scores where as beta coefficients that are less than 0.1 are quite weak in their effect on achievement.

The statistical regression program, Stata, was used to analyze the PISA data and apply econometric techniques to estimate the causal model. Regression analysis is a common way to examine the relationship between a particular dependent variable, achievement scores, to a variety of independent variables, which are the factors that affect educational achievement. For each regression on achievement in a particular subject area, all of the indicator variables being examined are included in one single regression and these are listed in the Regression Tables section. However, for ease of analysis only a portion of the regression will be shown in order to focus in on the effects of those variables, but those variables are still part of the larger regression. The quantity of R-squared in a regression is used to measure the "goodness of fit" and specifically explains how much of the variance of the dependent variable is explained by the independent variables. The R-squared values for my regressions are .52 and .49 for the math and science regressions respectively, which is quite good for this kind of regressions with only one year of data.

In each regression, listwise deletion handles the observations that have missing values. Listwise deletion is a statistical method by which observations with any missing value are removed and the regression is performed using only the observations with complete data for all of the variables in the regression. Responses denoted as missing, not applicable, or invalid are all considered to be missing in the analysis as they do not have a proper response to the question that the regression can utilize. The method of listwise deletion is statistically acceptable as long as the missing variables occur at random. The regression therefore consists of about 168,000 observations in total and the variables were chosen in such a way that the maximum percentage of missing variables in the majority of the indicators is less than eight percent; however, there is an exception for the variable that describes ability grouping, which has fourteen percent missing.

The causal model for analyzing educational achievement of students across various international countries must be sure to encapsulate all of the factors at work. Therefore, the model should include indicators that are part of the student's family background such as parent education achievement as their accomplishments contribute to the successes of their children. School characteristics are also an influential factor as the school provides the student with a particular learning environment and resources with which to pursue an education. Then there are characteristics particular to the individual student such as learning resources, studying habits and attitudes toward learning. All of these variables have been classed into five categories: family background, learning resources, school characteristics, approaches to learning, and classroom features. This paper delves further into those classes of variables to examine the features that affect student achievement.

Family Background

An individual's upbringing and family background tend to be important factors in determining educational achievement. This category consists of parent's pressure on academic standards, parents' educational levels completed, the work classification of highest parent, place of birth, and the language spoken at home. The expected outcome of students whose family emphasized education, were native to the country, and spoke the official language is that they should have a natural advantage and have higher achievement scores. In addition, having educated and skilled parents increases a student's propensity for high academic performance, and this is greatly confirmed by the results of the regression analysis.

One would expect that parents who take a greater interest in their children's education and set expectations for their children's academic success would have students that tend to perform better. This arises from the fact that the parents impose some academic pressure as they set up guidelines for their children to be focused in school and teach them to take education seriously. Parents who resort to a hands-off or lax approach towards education open the possibility for the child to be distracted by non-academic concerns.

In the causal model the indicator that addresses this question is the variable from the School Questionnaire that asks the school whether there is parental pressure placed upon the school to achieve high academic standards. The three categories are: majority of the parents apply constant pressure, a small group of parents apply pressure, or pressure from parents is mostly absent. The absence of parent pressure variable is the omitted variable and the other variables show their effect relative to this omitted variable. The results from the math and science regression indicate that when the majority of the parents place great pressure on the school there is an increase in the scores of the students. This makes sense because when parents collectively place pressure on the educational institution to perform better and strive for high academic achievement results the school is thus forced to comply and work hard to attain those goals as seen in the results. The beta coefficients for the responses indicating the majority of the parents are relatively larger compared to the case where we have a small group of parents applying pressure to the school. This smaller beta coefficient helps to mitigate the effect that when the parents who apply pressure are considered a small group we have a negative coefficient. The variable for a small group of parents in the science regression is not statistically significant as the probability that the null hypothesis is rejected is 21.7%, which is well beyond the usual 5% level of significance. The small group variable for the math regression is quite close to the border of significance and just barely satisfies the 5% criterion with a value of 4.2%.

Test Type	Group	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Majority	3.794127	.5215844	0.000	.016244
	Small group	-.835124	.4105879	0.042	-.0043944
Science	Majority	3.030178	.5436768	0.000	.0128741
	Small group	-.5279292	.4279789	0.217	-.0027567

One possible explanation for the fact that a small group of parents applying pressure lowers scores could be that the school consists of many parents that are not actively involved in the students’ education and thus it is difficult to incite change in the school when it is not a widely held view that the school should be pressured to strive for high academic standards. Another reason could be that when only a small group of parents apply pressure to the school it is typically in larger schools in which is harder for these schools to implement the practices necessary to achieve higher results effectively. This difference could also be attributed to the fact that the different categories of parents could correspond to different school sizes. When the majority of parents are applying pressure on the school to achieve high academic standards this could indicate a smaller school, since it is easier for a smaller community of parents to coordinate active involvement in school activities. A smaller school could possibly be associated with higher test scores in math and science due to the school’s more effective educational methods as compared with a larger school environment.

Another important factor to consider is the education of the parents. The model consists of two groups of variables for the parents' education that examine the mother and father's completion of the International Standard Classification of Education (ISCED) levels 1, 2, 3B/3C, or 3A (UNESCO.org). These data points come from a multiple choice answer for which the student denoted his mother's and father's top ISCED level completed, from 1 to 3. The ISCED is an international system to catalog the different level of education in a way that all systems are standardized and equivalence in programs can be determined. ISCED Level 1 corresponds to primary education or first stage of basic education, which for the U.S. would be kindergarten through fifth grade. ISCED Level 2 is defined as Lower Secondary or Second Stage of Basic Education, and ISCED Level 3 is Upper Secondary category and these encapsulate the grades in the U.S. of middle school for ISCED Level 2 and high school for ISCED Level 3 (UNESCO.org). Level 3A is refers to secondary school programs that specifically prepare students for university level education, where as Level 3B and Level 3C focus more on preparing students for a community college or a particular vocation respectively after secondary school. Thus parents who have completed a Level 3A should definitely provide their children with an advantage over parents with only a Level 2 or lesser education because parents with higher educational attainment can teach their children, assist them in their homework and also instill the central importance of education and the need to perform well.

The usual trend is for students whose parents completed more education to perform better in school and attain more educational credentials than do students from parents who had little education. The regression analysis confirms this notion for both mother and father education levels reported in the student questionnaire. There is a definite trend looking across the education level for one parent that the higher the education level attained, the higher the magnitude of the coefficient. This result shows that the higher the educational level of the parent, the higher the expected scores on both the math and science portions of the examination.

		Mother			Father		
Test Type	ISCED Level	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Math	3A	13.34388	1.0783	.0702137	14.50955	1.092149	.076351
	3B/3C	8.805905	1.121924	.0365099	9.762505	1.126821	.0424856
	2	4.597191	1.062004	.0184182	5.760177	1.083235	.0232895
	1	2.303337	1.077629	.0067685	4.319418	1.116718	.0123945
Science	3A	14.50782	1.123973	.0757548	14.57126	1.138408	.0760897
	3B/3C	9.818568	1.169445	.0403974	10.35604	1.174549	.0447241
	2	4.825233	1.106987	.0191841	5.429938	1.129117	.0217865
	1	2.827996	1.123273	.0082468	4.924018	1.164018	.0140214

Another clear trend is the fact that the beta coefficient increases as education level of the mother or father increases. This means that the fact that a parent has completed high school has a stronger positive impact on their child’s achievement scores than does the fact that they completed elementary schooling. One interesting note is that although the effect of parent education is about equal for both mother and father in science, there seems to be a slight difference in the math subject exams. The father’s completion of educational level seems to be a stronger influence for math achievement scores as the beta coefficients are slightly larger than for the mother’s education. This could be related to the perception that men tend to perform better in math and the fact that the father does well in math could mean that they pass along their acquired skills to their children or take the time to teach them or assist them in their math studies.

Another variable that is closely related to parent education is the work classification of the highest parent. “Pedagogy nowadays has to fight with problems related to class-levels in society: workers’ and migrants’ children,” making the analysis of work classification levels important for understanding academic performance (Siemsen 316). This indicator is related to parent education, as individuals who qualify higher work classifications usually hold a certain level of education. The progression of work classifications is Blue Collar Low Skilled, Blue

Collar High Skilled, White Collar Low Skilled, and White Collar High Skilled. In our analysis the variable for Blue Collar Low Skilled has been omitted so that the coefficients of the dummy variables for the other classifications reflect how much better a parent with one of the other work classifications would fair in comparison with the parents of the Blue Collar Low Skilled category. The expectation for this variable is where one would predict: that having a parent with a higher work classification leads to better achievement scores. That is exactly what the results show. All students whose highest parent's work classification is greater than Blue Collar Low Skilled have higher math and science achievement scores. Again there is the trend that the regular coefficients and beta coefficients rise as we look at the highest parent having a higher work classification. Students whose highest parent's work classification is that of a White Collar High Skilled worker are significantly impacted by this quality. A beta coefficient of a .091 and .094 for math and science respectively is quite substantial, as this quality alone increases the student's scores by around 17 to 18 points on the PISA examination.

	Math			Science		
Parent's Work Class	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
White Collar High	17.38657	.6266419	.0912573	18.04896	.6531842	.09401
White Collar Low	5.955759	.6421108	.0262991	6.350619	.6693082	.0278283
Blue Collar High	2.365248	.6768011	.0086529	2.878698	.7054679	.0104508

Family background is shaped by other factors in addition to parents' education and work classification. The immigration status of the students and their parents can also have an impact upon academic performance. Being born in the particular country one lives in can have an impact upon one's educational success. There are sometimes positive qualities associated with being born in the country such as being familiar with the educational institution, the language, and integrating into the school community. The PISA survey includes a particular question about whether the student, their mother, or their father was born in the country. The results from the regression analysis are listed in the following table.

Test Type	Born in Country	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Self	5.628278	.8595559	0.000	.01329
	Mother	-.6903371	.7004746	0.324	-.0023595
	Father	2.061462	.6919046	0.003	.0069909
Science	Self	4.62868	.8959635	0.000	.0108461
	Mother	.3455719	.7301441	0.636	.0011721
	Father	2.980106	.7212111	0.000	.010029

It seems that the most important factor in terms of scores in this group of variables is the individual student being born in a country as this has a positive impact on both math and science scores. The father being born in the country also has a positive effect on the student's scores in both subjects; however, it is stronger for science than it is for math. Lastly the fact that the mother is born in the country is statistically insignificant in both the math and science regressions as the p-values for both regressions are 32% and 64%. The lack of statistical significance in the case of the mother's place of birth results in the small beta coefficients and also could account for the fact that one is positive while the other is negative. Overall if the student or the student's father is born in the country of the examination this is a positive influence, although by the small size of the beta coefficients $\approx .01$ it is clear that place of birth is one of the less important factors when determining student achievement.

A factor that does have a more important role in contributing to student achievement is that of language. Whether the student speaks the language of the test at home or some other national language makes a big difference. In my regression the results compare the effect of speaking the language of the test or other national language to that of speaking neither at home. It is logical that a student who speaks one of these main national languages at home should perform better on tests that measure academic achievement. Due to their development of the language at home these students attain a proficiency in the language that allows them to better understand and absorb the material taught in the classroom.

The results strongly affirm the predicted outcome that speaking the language of the test or the national language at home has a strongly positive impact on achievement scores. There is an interesting dichotomy between math and science. For math the relative impact of speaking the language of the test or other national language at home seems to be close in magnitude. The fact that a student speaks the language of the test at home has a slight advantage to a student who speaks another national language at home. The relative impact on the math scores are also not as high as for the science scores and this is most likely due to the fact that the language skills in math are primarily used for understanding the question being asked. A good portion of math deals with the universal language of numbers rather than with words, except in word problems. In science, language skills are much more important as learning the discipline requires reading in the language and the answers are normally of the multiple choice word format or short answers.

	Math			Science		
Language Spoken at Home	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Language of Test	9.868693	1.04767	.0333552	22.88102	1.092046	.0767444
Other National Language	8.453492	1.219153	.0245593	16.65765	1.270791	.0480243

Looking at science, the effect of speaking the language of the test at home is very important as the beta coefficient is .0767 and speaking another national language at home only improves the score according to the beta coefficient by .048 standard deviations. Language definitely has an important role for strong performance in science and the effects are quite important relative to the overall category.

The last factor included in the family background category is that of gender. The age long debate revolves around whether boys or girls perform better in the math and science fields. It is important to include this variable in the model because the causal model aims to include all factors that contribute to a student's academic achievement and gender does explain some of the variance in the dependent achievement score variables. In the regression males students tend to perform better by 20.4 points in math and by 11.9 points in science compared to females. This results lean towards the argument that males perform better in both of these technical areas compared with females, who tend to dominate the reading and language arts disciplines. One study defines the origins of the difference as:

Effect of Gender (Male)			
Test Type	Coefficient	Standard Error	Beta Coefficient
Math	20.40598	.3267143	.1073726
Science	11.91407	.3405527	.0622106

> "Gender gaps may be attributed to the organisation of national school systems, gender differences in aspirations (expectations) or macro-societal factors, such as the level of economic development or modernisation, societal inequality, gender inequalities in the labour market and the size of the welfare state." (Marks 93)

Thus the gender differences are mainly a function of societal influence upon student "aspirations" and opportunities for members of both genders in society. Marks, however, mentions that in the gap between males and females studies show that there is "perhaps declining gender differences favouring boys" as female performance improves (91). The size of the beta coefficients for the gender indicator in both math and science regressions is fairly substantial as it is greater than .06 and thus gender is an important factor for understanding the drivers of the educational achievement relative to the PISA achievement scores in math and science.

After analyzing all the family background variables it is clear that all of the characteristics behaved in accordance with what a person could logically assume. It is clear that students that have parents with higher levels of basic education, parents with a high work classification, majority of parents actively pressuring the school about education, or if the student speaks the country's language at home they are all at an advantage and are set to attain higher scores on a test measuring educational achievement. The relative impact of all of these influences differs, as some have a stronger impact than others. By comparing the beta coefficients it is evident that in the field of math and science the common strongest indicators were having one's father that completed ISCED level 3A, having one's mother completed ISCED level 3A, and having the highest parent's work classification be White Collar High Skilled. Each discipline also had its own indicator that specifically for its subject makes a reasonable impact. In math, gender was actually the strongest factor for driving achievement in the discipline. For science, one of the leading drivers was speaking the language of the test at home. All of these indicators had beta coefficients of .07 or greater and that is fairly significant. Thus the pivotal points of family background are parental education, work class, gender, and the language spoken at home.

The factors that make up family background are typically cultural and inherent and are not characteristics that can be readily changed. One option for change is that parents could make sure to practice the language of the test by speaking it at home and developing a child's language skills and setting them up for success. However, the key features also indicate that for future generations the overall educational attainment in degrees conferred on today's students does make a difference in the educational achievement for their future children.

Learning Resources

Now I will look at some characteristics that are not exclusively inherent like family background and examine the effects of learning resources. Students require certain tools in order to succeed in their educational studies and this section seeks to explore the importance of particular resources available to individual students and their respective impacts on the student's achievement scores. By properly equipping a student with the proper tools, such as books and computers, a school can make a difference in a student's performance. One of the main arguments for the lower test scores of some inner-city schools in the U.S. is a lack of resources. This point of view has some merit, but the real question is if this is the entire story. By exploring the relative importance of student's tools for education we can better approach this question and determine how important a factor these learning tools are in comparison with the other forces at work. This section will also explore some possessions that can be considered as a proxy for measures of family wealth and examine their relationship to academic scores.

The first factor in this category of learning tools is the ratio of computers to students in the school. The higher value of more computers per student is thought to be associated with higher educational performance as computers are an important educational resource that students should have, and greater accessibility to them improves their scores. The regression data shows that in science, the ratio of computers to the total students has a positive effect as expected; however, it is quite minuscule as the beta coefficient is only .006. For the math test, the regression showed that the variable was statistically insignificant as it had a p-value of 28.7%, which is far from the necessary 5% level of significance, thus the coefficient has no real use in the analysis. Therefore, although the ratio of computers to total students seems like it should have a greater effect, the results show that this factor is actually not as important in affecting students achievement scores.

Ratio of Computers to School Size				
Test Type	Coefficient	Standard Error	p-value	Beta Coefficient
Math	1.200427	1.127873	0.287	.0022759
Science	3.238275	1.175645	0.006	.0060925

Next we have a long list of items that most educators would consider to be essential learning resources for students. The questionnaire asks students whether they have these items in their home and the list includes: a desk to study at home, having one's own room, quiet place to study, computer to use for studying, educational software, internet connection, calculator, classic literature, books of poetry, works of art, books to assist in school work, and a dishwasher. The results indicate that for the math regression the most important factors were the ownership of a computer for study, internet connection, and classic literature as all of these variables had beta coefficients that were greater than .05. This is interesting as one would assume that a desk and quiet place, would be the most important, yet these indicators had beta coefficients that were less than .01. A moderate factor of importance is the ownership of a calculator, which is important for math. The ownership of a dishwasher also has a moderate effect and it represents a luxury item for the typical household. As expected a DVD or VCR has a negative effect on student performance as it distracts them from their studies; however, the effect is low compared to what one might expect. Lastly, in the math regression having one's own room was statistically insignificant. Most of these variables are significant due to the high number of observations.

	Math Regression				Science Regression			
Possession	Coefficient	Standard Error	p-value	Beta Coefficient	Coefficient	Standard Error	p-value	Beta Coefficient
Desk to study at home	2.934474	.6300064	0.000	.0087522	2.374024	.6566912	0.000	.0070265
Own room	.3803714	.453705	0.402	.0015752	.3183608	.4729223	0.501	.0013084
Quiet place to study	1.380443	.5368931	0.000	.0046792	.9507099	.5596339	0.089	.0031979
Computer to study on	13.34807	.9469382	0.000	.0541992	13.39536	.987047	0.000	.0539755
Educational software	-1.576333	.377221	0.000	-.0082784	-3.564008	.3931987	0.000	-.0185741
Internet connection	10.54826	.5232222	0.000	.0504632	9.671316	.5453839	0.000	.0459143
Own calculator	7.79397	.6712755	0.000	.021589	6.81349	.6997083	0.000	.0187288
Classic Literature	10.13522	.4025321	0.000	.0528094	12.92527	.4195819	0.000	.0668322
Books of poetry	-1.86982	.3926185	0.000	-.0097656	.2960494	.4092484	0.469	.0015344
Works of art	-.7421089	.3669943	0.043	-.0038149	.3115289	.3825389	0.415	.0015892
Books to assist in school work	3.424956	.5257146	0.000	.0119101	2.905847	.5479819	0.000	.0100277
Dishwasher	8.445312	.9837151	0.000	.0152219	7.673553	1.025382	0.000	.0137252
A DVD or VCR	-2.826157	.6487592	0.000	-.0083604	-3.053644	.6762383	0.000	-.0089643

Now looking at the science regression of these possessions, the important variables are the ownership of a computer for study and classic literature whereas an internet connection, calculator, and dishwasher have moderate effects. This time a quiet place to study and works of art are both statistically insignificant in addition to having one's own room.

From this group of resources one can ascertain that computers for study and classic literature are most important in driving achievement scores. The reason for this is that a computer is an essential tool for learning and conducting research using the internet. Interestingly, having some classic literature at home seems to be a driving force. This can be attributed to the fact that households that are cultured in the works of great literary writers could have a connection to reading and taking part in leisure activities such as reading that are conducive to learning. There could be spillover effects to the individual's education in the classroom.

Another important connection to the performance of a student is the relative wealth of the family, as coming from a wealthier family could possibly afford the student more needed resources to help them to excel in their education. The ownership of items such as cell phones, computers, and cars can be used as proxies for wealth. However, the ownership of televisions is a separate case: although this variable does represent wealth the negative impacts of owning more televisions as far as a distraction factor outweigh the wealth implications. All of these indicators examine the relationship of owning one, two, or more of these items in comparison with someone who owns none and are specified using multiple dummy variables.

First, the ownership of one cell phone is not statistically significant for either of the regressions. The results indicate that a household owning two cell phones has moderately important positive impact, while three or more cell phones has a lesser positive effect.

Here are the results for the effects of owning a particular number of cell phones in a household:

Test Type	Cell Phones	Coefficient	Standard Error	p-value	Beta Coefficient
Math	One	1.347536	1.013305	0.184	.0038753
	Two	6.122852	1.00478	0.000	.0219079
	Three or More	5.742271	.9953146	0.000	.0263749
Science	One	.2907021	1.056225	0.783	.0008296
	Two	5.217205	1.047339	0.000	.0185248
	Three or More	2.759394	1.037472	0.008	.0125774

For math scores the relationship is a good linear fit that supports the wealth factor and the associated benefits that manifest in higher achievement scores. However, for the science regression the output is not quite linear as three or more cell phones have a reduced effect compared to two cell phones. One possibility is that households with two cell phones is actually a good indicator of family wealth and thus the student's improved achievement scores are a product of the family's stronger finances that could allow them to better provide for their student. However, in the presence of three or more cell phones in the household this could mean that children are using cell phones and this could provide a distraction to their education. Thus in the case of the science regression, students who are using cell phones show that the distraction starts to outweigh the wealth benefits.

The ownership of televisions by household has commonly been one of the main detractors to a student's education; therefore this variable has been included in the model to further examine this relationship. One would expect that owning more televisions would reduce a student's expected achievement as the student would spend time watching non-educational television shows that would take away from time that should be spent studying. Interestingly, the ownership of one television was not statistically significant for both disciplines and neither was the variable for owning two televisions in the science regression. From the results it is evident that owning more than two televisions is a serious detractor. As the number of televisions in the household increases, the student's scores in math and science decrease.

Test Type	Number of Televisions	Coefficient	Standard Error	p-value	Beta Coefficient
Math	One	.9983782	1.720501	0.562	.004174
	Two	-3.455305	1.736034	0.047	-.0173647
	Three or More	-10.03766	1.747607	0.000	-.0524884
Science	One	2.848883	1.793375	0.112	.0118196
	Two	-2.959344	1.809566	0.102	-.0147586
	Three or More	-11.47297	1.821629	0.000	-.0595354

One possible explanation is that with more televisions in the household it is easier for the student to watch television whenever he or she chooses. The ownership of three or more televisions has the implication of a television being present in the individual student's own room, which is most definitely not conductive to focused studying. The negative effects of television are actually quite substantial as the beta coefficient for a household owning three or more televisions is -.052 and -.059 for math and science respectively.

Computers, on the other hand, tend to be positive influences for students as they are tools that enhance a student's learning capability and increase the amount of resources available to the individual. It seems that the number of computers in one's house is indicative of wealth as computers tend to be quite expensive and owning multiple computers is definitely something that not many can have. The truth of the matter is that computers have revolutionized the way we approach education as they allow students to perform research, write papers, and much more all with the click of a button. Computers also multiply the resources available to individuals because many references and devices such as calculators, dictionaries, and encyclopedias are available on many of these machines. Thus computers have had a largely positive effect upon the education of students. Looking at the regression results, the positive relationship clearly shows that as the number of computers in the household increases, so do the students' math and science scores. This reflects of the fact that having more computers in the household means that students have more access to utilizing a computer for study.

	Math			Science		
Number of Computers	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
One	6.691064	.9899692	.0351876	7.277059	1.031901	.0379768
Two	12.82446	1.06899	.0559662	12.70762	1.114269	.0550324
Three or More	19.28549	1.132216	.0696434	19.01767	1.180173	.0681514

The beta coefficients for computer ownership are fairly significant as they are above .05 for both two and three or more computers with respect to scores from both the math and science regressions. The ownership of multiple computers in the household seems to be a serious driving force for student education, which seems to make it an essential tool for facilitating student success.

The model also looks at the number of cars in a student's household, which is the last indicator for wealth. The overall effect of car ownership on a student's achievement scores is almost the same for both math and science, and its magnitude of impact is only moderate to relatively low as the beta coefficients are .02 or less. One general observation from looking at the results is that there is a positive linear relationship where owning one car is beneficial as opposed to owning none. However, owning three or more cars seems to be slightly detrimental to a student's achievement. One possible explanation for this occurrence is that although wealth is a generally positive factor, there could be diminishing marginal returns that actually become negative as one's wealth surpasses a particular level, which is evident in households that own three or more automobiles.

Test Type	Number of Cars	Coefficient	Standard Error	Beta Coefficient
Math	One	4.146572	.555445	.0209636
	Two	3.887393	.6230153	.0190823
	Three or More	-2.933548	.7232805	-.0109133
Science	One	2.321215	.5789716	.0116455
	Two	1.364255	.649404	.0066456
	Three or More	-6.502883	.753916	-.0240069

Last on my list of important learning resources is the ownership of books in the household and how the number of books can actually make a significant difference. This variable shows the effect of having a particular number of books and compares it to students who have only zero to ten books at home. The beta coefficient is extremely useful for a question such as this one because the number of books owned is grouped into categories that are of different sizes. A logical conclusion is that a household that owns a greater amount of books fosters a student's intellectual aptitude as books are an integral part of one's life, especially for those students that happen to have a collection of a hundred books.

	Math			Science		
Number of Books	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
11 to 25	5.083856	.6164921	.020146	6.663137	.6426044	.0262025
26 to100	19.38492	.6025598	.0941492	20.23074	.628082	.0975063
101 to 200	31.06791	.6866611	.1259452	33.90935	.7157455	.1364135
201 to 500	44.85196	.7472086	.164316	46.07068	.7788576	.1674908
More than 500	47.79136	.8554935	.1353502	49.83354	.891729	.1400552

The results clearly support this relationship that the higher the number of books in one's home, the higher the scores as for both math and science. These effects are some of the largest drivers off educational achievement seen thus far for all of the indicators examined. The ownership of any number of books greater than 25 produces beta coefficients greater than .09, which makes them very important factors for students to excel in school. It seems that there is a slight reduction in the positive effect of book ownership in the category of more than 500 compared to 201 to 500. This implies that at such a high number of books, additional books do not seem to have as strong an impact as they do in the transition from the 11 to 25 category to the 26 to 100 category. Books are an essential part of learning as they are filled with information that can greatly enhance the performance of a student and the analysis strongly confirms this statement.

Reflecting upon the different indicators of this category focusing on learning resources, it is clear that the strongest learning tool driver of educational achievement is the number of books in one's household. Simply owning more than 25 books had the largest impact by far over any of the other possessions a student could have at home. The next most important learning resources were the variables for owning a computer at home for studying and owning classic literature. Classic literature is clearly related to the number of books one owns as it contributes to the total collection of literary works. However, it is interesting to note that the correlation between classic literature and variables for number of books owned is actually less than 0.18 (quite low for a correlation), which indicates that the two variables are somewhat distinct and not collinear. Computers were the other important learning tool that helps drive educational achievement. In today's age computer usage is growing at a rapid rate and so is the content online, which means that the number of resources available to students is constantly increasing. In addition, computers have revolutionized the way students do their school work as some homework assignments are given online and many papers are typed rather than hand written, which makes owning a computer for study purposes a clear essential for students today. Thus the main drivers as far as learning resources are those that provide students with written information and ways to produce one's own written compositions and these triumph over other learning resources such as a studying environment and over the wealth effects of cell phone and car ownership.

School Characteristics

The qualities that make up a school and its identity powerfully shape the student's learning experience, and particular aspects of certain schools facilitate strong student performance. A variety of aspects are associated with the school such as institutional standards, educational enrichment activities, and industry influence on curriculum. This category examines numerous indicators relating to core school characteristics based upon the responses from the School Questionnaire portion of the PISA survey. Countries and regional governments find qualities pertaining to educational institutions most interesting as they have direct control over the operations and standards imposed on the schools. By exploring this category it is possible to determine some key features of schools that set up students for success in educational achievement.

An important part of measuring educational performance is achievement examinations and standards. The question lies in how educational goals and standards should relate to aspects such as public listings of scores, performance ratings of educators, and achievement tracking in general. These following indicators examine the effect of educational achievement standards and evaluations to see if it has an effect upon students and their achievement scores. Looking at the math results, only publicly listed achievement scores and teacher evaluations had discernable effects, while variables for principal evaluations and achievement tracking over time were statistically insignificant. Publicly listing achievement scores had a positive effect on math scores and this could stem from the incentive to perform better in order to demonstrate competence in the view of one's classmates. The effect is moderately positive as the beta coefficient is .015. Achievement scores used to evaluate teacher performance have negative effects of almost equal magnitude. This outcome implies that when teachers are evaluated upon student performance on achievement examinations they tend to focus mostly on the exam being given rather than teaching toward developing an individual with well-rounded knowledge. The PISA test is not the sort of exam that teachers would be evaluated on and this refers mostly to yearly achievement examination conducted either by the school, state, or nation.

Test Type	Score Aspects	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Listed Publicly	3.027201	.3882834	0.000	.0153636
	Principal Evaluations	-.864921	.4522119	0.056	-.004305
	Teacher Evaluations	-2.720449	.4421258	0.000	-.0143179
	Tracked over Time	-.4254099	.4027612	0.291	-.002083
Science	Listed Publicly	2.643272	.4047296	0.000	.0133125
	Principal Evaluations	-1.43862	.471366	0.002	-.0071058
	Teacher Evaluations	-2.762685	.4608526	0.000	-.0144291
	Tracked over Time	.3627631	.4198207	0.388	.0017627

Shifting focus to the science regression, the consequences of listing achievement scores publicly and evaluating teacher based on standardized tests are almost identical to those of the math regression. One addition is that the evaluation of principals based upon achievement scores is statistically significant and is negative just as it is for teacher evaluations, but the effect is much smaller.

Overall the effects of achievement scores being listed, tracked, or used in evaluations are small. Lessons learned are that publicly listed achievement scores do drive achievement as it incites some students to perform better. However, using achievement scores as standards for evaluation is generally a poor choice as it limits teachers and principals only to teach to the benefit of an exam rather than to teach to the general benefit for the student's education.

The model also includes the impact of other schools in the area. The idea behind this indicator is that, given an option among schools, students could choose the school that would better prepare them in their education and thus have more control over one's school. However, the results of both the math and science regressions indicated that it clearly did not matter whether additional one, two, or more schools were available nearby for the student to attend as all of these variables were statistically insignificant, failing the 5% significance level standard.

Test Type	Other Schools Available	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Two or more	.1274827	.4382035	0.771	.0006475
	One	.318715	.5635288	0.572	.0011755
Science	Two or more	.8270144	.4567641	0.070	.0041687
	One	.4441684	.5873978	0.450	.0016257

There are some schools that consider academic performance of the individual student as part of the criteria for admission to the institution. In the regression this indicator considers that effects of schools in which a student's academic record is a prerequisite, a high priority, or considered, and compares its effect to schools that do not consider academic record as a criterion for admission. One would expect that schools that consider a student's academic record would tend to have a higher percentage of high-performing students as opposed to a school that did not base an individual's admission upon this fact. Thus, the students should have higher achievement scores for attending schools that consider or require a certain level of prior academic performance. The results from the regressions confirm this notion as there is a moderate benefit to attending a school that consider academic recorders for admission or ones that hold it as a high priority. The beta coefficients of those indicators have values around .015, which would make a difference. However, students that attend schools where prior academic performance is a prerequisite for admission experience a much stronger impact, with beta coefficients of .05 and .045 for math and science respectively. One could argue that the impact of the schools admission criteria is not the real reason behind the scores.

	Math			Science		
Academic Requirement	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Prerequisite	11.91255	.5516788	.050878	10.62718	.5750458	.0450414
High Priority	4.930898	.6338805	.0158986	4.98254	.6607293	.0159423
Considered	3.479139	.4612335	.0154923	3.230005	.4807696	.014273

Instead the higher achievement at those schools originates from the fact that since they impose academic selection they attract and accept smarter students into their institutions and turn away students that do not meet their academic levels for admission. Another argument could be that the facilities or teaching methods tend to be more effective at schools where the academic records factor into the admission. However, once students have been admitted or accepted to whichever school they attend, it is important to investigate the effects of the actual curriculum and extracurricular activities.

Many parents and educators wonder how beneficial extra educational programs relating to science and general topics are to students. Some schools dedicate a considerable amount of funding to support various extracurricular activities in the sciences such as clubs, fairs, competitions, projects, and excursions. There are several advocates of extracurricular activities that attribute the academic benefits to the notion that it provides students with the opportunity to apply the knowledge they learned in the classroom. The question is whether these funds are well spent and actually work to drive educational achievement and if so this could justify further investment into extracurricular science activities.

	Math			Science			
Scientific Activity	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	p-value	Beta Coefficient
Clubs	1.997223	.4036248	.0104711	2.791483	.4207209	0.000	.0145234
Fairs	.7877487	.3994854	.0041438	.2712387	.4164061	0.515	.0014159
Competitions	1.368788	.4284937	.0070424	.6353282	.4466432	0.155	.0032438
Extracurricular Projects	1.454157	.3804412	.0076231	.6094111	.3965553	0.124	.0031703
Excursions	-.7263795	.6121038	-.0023732	.9516244	.6380303	0.136	.0030854

Looking at the math regression of these variables it seems that there is a benefit to having science clubs and these have a moderate positive effect. Fairs, competitions, projects, and excursions all have little to no effect on individual student's math achievement scores. All of these minute effects are positive as they can be construed as having educational benefits, except for excursions, which take students away from the classroom. In the case of the science regression, clubs are again the most influential of these extracurricular science related activities. In fact the effect of having science clubs is stronger for science achievement scores than it is for math, which makes sense as it is a club specifically for that particular discipline. However, all of the other science related extracurricular activities are insignificant in the science regression. This is quite unexpected as one would expect science activities to be strongly related with science achievement scores and not be insignificant factors. Thus it seems that science clubs are the best type of science extracurricular activities as they derive the greatest benefit as far as producing higher achievement scores in math and science. If a school were planning on instituting new programs or reallocating its budget it should first reduce science excursions and increase funding in favor of science clubs.

Extending beyond science extracurricular activities to general ones, one could expect that these sorts of activities would have a similar moderate effect on the math and science disciplines, but would not be strong driving forces for student achievement. For general activities the model includes outdoor education, museum trips, trips to science/technology centers, and guest speakers. All of these activities are positive reinforcements of classroom lessons; however, the results support the fact that their effects are minor. Most of these indicators were not statistically significant in either the math or science regression. Only the variable for guest speakers was a minute positive factor for math achievement scores; however, its effects are almost negligible.

Test Type	General Activity	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Outdoor Education	.7556329	.4230762	0.074	.0034578
	Museum Trips	-.2568682	.4529486	0.571	-.0011746
	Trip to Sci/tech centers	-.1837413	.4284749	0.668	-.0008979
	Guest Speakers	1.064545	.3933464	0.007	.005452
Science	Outdoor Education	1.323015	.4409962	0.003	.0060079
	Museum Trips	.1355191	.4721338	0.774	.0006149
	Trip to Sci/tech centers	-.4997484	.4466235	0.263	-.0024234
	Guest Speakers	2.36117	.4100071	0.000	.0120002

In science, outdoor education and guest speakers were positive influences on student performance. Outdoor education was a small factor just as speakers were for math. Yet, guest speakers had a moderate positive effect for science students as the beta coefficient was .012. Thus the outcomes indicate that general extracurricular activities are not strong drivers for student education as one may usually assume. In fact, extracurricular activities in both general and science groups were among the weakest drivers of education examined in our model thus far.

Besides extracurricular activities some schools look towards developing students for the job market at an early age through apprenticeship programs. Apprenticeships are where students receive training at local businesses. Countries, such as Germany, actually make vocational experience a requisite part of the student's education and advocate apprenticeships (Carey 42). Opponents of the apprenticeship program would argue that spending class time on learning trades of local businesses reduces the amount of time students spend in the classroom on typical lesson plans. The variable that investigates this effect compares schools that offer training in local businesses to a portion of the students (half or less and more than half) to schools that do not offer this type of learning approach. The regression analysis shows that these apprenticeships have a moderately negative effect upon student achievement in both math and science. When more than half of the students received some training at local businesses there scores dropped by 5 points for math and 3 points for science.

Test Type	Apprenticeship	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Half or less	-1.744897	.5202178	0.001	-.006443
	More than half	-5.501848	.6521398	0.000	-.0198689
Science	Half or less	-.6587917	.5422523	0.224	-.002414
	More than half	-3.952882	.6797621	0.000	-.014166

Thus, the thinking that apprenticeships do not derive the added value for student achievement is confirmed. However, a student that receives this type of training may in fact derive benefit from such instruction if they are looking to enter the same vocation as the apprenticeship.

The effect of industry on educational curriculum is closely related to apprenticeships as it examines the effect of including firms in shaping a student's education. This variable compares the effect of curricula that have minor or considerable industry influence versus schools that have no industry influence. Possible positive effects from industry influence upon curriculum originate from firms donating funding for specialized programs that include projects that apply classroom lessons to real life situations to examine issues that actual firms face. On the other hand, industry influence could reshape the curricula in such a way that removes essential parts of a student's education. Missing particular lessons could result in lower achievement scores. Out of the two potential conflicting effects, the latter seems to be true, as students' scores in both math and science dropped for schools in which minor or considerable industry influence played a role in shaping the curriculum.

Test Type	Industry Influence	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Minor	-.7702786	.3875349	0.047	-.0040534
	Considerable	-2.961865	.5982704	0.000	-.0104049
Science	Minor	-.6232248	.4039494	0.123	-.0032545
	Considerable	-3.554426	.6236109	0.000	-.0123912

For math scores, the effect of having minor industry influence is negligibly small with a beta coefficient of only -.004, while considerable industry influence does have a greater negative effect with a beta of -.010. Looking at the effect of the variable upon science achievement scores, the case of minor influence is statistically insignificant and the considerable influence parameter displays a negative effect tantamount to the result in the math regression. Thus from the analysis of industry influence, it is clear that this indicator has a minor negative effect that is small when we compare its beta coefficients to other variables within the realm of school characteristics.

The main driver within school characteristics, based upon the highest beta coefficients, was the variable for attending a school that required pervious academic performance for admission and the beta coefficients were .050 and .045 for math and science respectively. This indicator inherently separates out the higher performing students through the admissions process. An interesting discovery in the analysis of school characteristics is that most of the effects were fairly weak in determining student achievement, which stands to reason that the school ability to drive achievement with these particular variables is limited. Interestingly, most of the school characteristics that are commonly thought to greatly enrich the educational system such as clubs and activities all had minor impacts upon student achievement as the beta coefficients were all in the vicinity of ±.01 to ±.001. Apprenticeship programs and industry influence had mild negative impacts upon student performance. Overall these characteristics individually might not change a student's performance, however, by combing a number of them together in a school system there is potential for the educational institution to have a positive impact.

Approaches to Learning

This category consists of a variety of indicators that examine the importance of classes, length of lessons, and self-study from the PISA Student Questionnaire. All of these variables stand to describe the various learning approaches, reveal student motivation, and discuss the effect of lesson durations. This section is a combination of both school and student forces for which both entities can have an impact depending upon their respective styles of education.

Student motivation and attitude toward learning and succeeding in school can play an important role in driving academic achievement. When an individual values success in school, he or she works harder to reach the goal of high performance. Thus that added effort associated with the importance of a particular subject should produce higher scores in that respective area. The Student Questionnaire of the PISA data asked students how they ranked the importance of doing well in science and math as: very important, important, and little importance. These choices examine the effects upon performance relative to students who do not place any importance upon doing well in a particular subject. The expected outcome is that students who place some importance upon performing well in math or science should have higher scores, and this positive effect should increase as the level of importance increases.

	Math			Science		
Importance of doing Well in Science	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Very Important	22.83479	.9491747	.1127864	34.78256	.9893782	.1704862
Important	14.63806	.914199	.0766225	23.03737	.9529211	.1196668
Little Importance	5.990692	.9312046	.0245872	10.39264	.9706469	.0423279

The results of the regression of math and science scores upon the importance of doing well in science strongly support a positive relationship. It is clear that there is a relationship between math and science as both subjects see a benefit from importance placed upon doing well in science. However, the relationship favors science scores as one would expect as science scores derive a larger benefit from students that value performance in their science classes. The beta coefficients for students who value doing well in science as either important or very important are .07 and .11 respectively for the math regression. Looking at the science regression those same beta coefficients are .11 and .17 for important and very important. These beta coefficients are large and indicate that students valuing high performance in their science classes is an important driver for both science and math scores.

In addition, the model includes the analog variable that asked students to rate how important doing well in math was to them. These results largely mirror the case for the importance of science, showing a positive relationship between caring about class performance and actual test scores in both math and science. The impact of this variable upon math scores was stronger for the math regression compared to the science regression, as expected.

	Math			Science		
Importance of doing Well in Math	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Very Important	26.97421	1.456385	.1396609	10.9836	1.518072	.0564337
Important	19.13428	1.454602	.094654	7.534108	1.516214	.0369851
Little Importance	9.81778	1.538508	.0259017	4.77484	1.603674	.0125009

Again, the beta coefficients are big. As for the math regression, they are .09 for important and .14 for very important. However for the science regression, although the variables are strong factors, the beta coefficients of both: important and very important, are less than half of what they are for the math regression. This is interesting to note because regarding importance of science before, the off subject of math had beta coefficients that were about three-quarters the size of the science regression's beta coefficients. This relationship could indicate that there is a stronger spillover from science to math than there is from math to science. Overall the regression outcome clearly shows that how much students care about their academic performance largely drives their achievement scores.

Another key area for student performance that relates to effort is the amount of lesson time that an individual spends on a particular subject per week. The more time spent studying or learning a particular subject could have a positive or negative effect as there are two conflicting factors. It could have a positive impact if an individual gains more knowledge and becomes adept in a particular subject by spending more time learning material in lessons or studying. However, more hours spent in lessons or studying could also have a negative effect if only students who perform poorly require longer periods of instruction or study. The regression model includes variables for hours studied in math and science that fall into three categories: regular lessons, out of school time lessons, and self study. The variable of “regular lessons” refers to instruction occurring at school during normal hours, while “out of school time lessons” considers lessons a student takes in addition to regular lessons, and “self study” refers to individual time spent by the student studying or completing homework. These are all distinctive type of lessons each with their own particular strengths and implications. “Regular lessons” is a compulsory variable that the school controls and students must attend, yet “out of school time lessons” and “self study” is a voluntary decision of time allocation, which depends upon the student and parents. Possible durations of regular lessons include: less than 2 hours, 2 to 4 hours, 4 to 6 hours, and 6 or more hours. All of these durations are analyzed in comparison against the student whose hours of lessons or studying is zero.

The first variable of this lessons group looks at the effect of regular lessons upon a student’s academic performance in either math or science. Regular lessons should have the greatest impact upon an individual’s education as it is the core instruction by teaching professionals at the schools. The regression analysis supports this view as there is a clear benefit to more hours of instruction in both math and science at school.

Looking first at the variable for regular math lessons and its impact upon both math and science, students experience a positive benefit from increased hours of instruction:

	Math			Science			
Math Regular Lessons	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	p-value	Beta Coefficient
Less than 2 hours	2.637888	1.176259	.0089994	2.078901	1.226081	0.090	.0070382
2 to 4 hours	24.76854	1.141529	.1246345	24.06995	1.18988	0.000	.1201935
4 to 6 hours	31.21778	1.155669	.1601802	29.56117	1.204619	0.000	.1505207
6 or more hours	22.94199	1.247264	.0771067	21.07882	1.300093	0.000	.0703033

The beta coefficients for the different durations of regular math lessons are almost identical for the math and science achievement regressions. All of the variables are statistically significant except for the variable in the science regression of a student receiving less than 2 hours of regular math lessons. Receiving 2 to 4 hours and 4 to 6 hours of math lessons have high beta coefficients of .12 and .15 respectively. This confirms the notion that time spent in a classroom is conducive to learning the material such that the students can perform well on standardized examinations. However, for students that spend 6 or more hours, there are diminishing marginal returns as the payoff for those longer lessons returns a beta coefficient of only .07 which is half the benefit of lessons lasting between 4 to 6 hours. A reason for this could be that in extended prolonged sessions of math study students begin to lose focus, rather with shorter lessons lasting 2 to 6 hours the student can effectively absorb and later apply the mathematical concepts.

Now looking at the case of regular lessons in science the results are similar to those of the regular lessons in math, displaying a positive benefit. Again the math and science regressions are almost identical in their responses to the particular hours of regular science lessons.

	Math			Science		
Science Regular Lessons	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Less than 2 hours	2.136326	.702464	.0092648	2.690851	.7322178	.0115804
2 to 4 hours	17.89542	.7077405	.090902	18.02388	.7377178	.0908548
4 to 6 hours	33.89071	.7751477	.1456693	34.5732	.8079801	.1474671
6 or more hours	52.19169	.862753	.1760268	51.43454	.899296	.1721473

The beta coefficient for the range of 2 to 4 hours is .09 and for the range of 4 to 6 hours it is .14 denoting that they are both strong drivers of educational achievement. However, in this case, there are no diminishing returns for students who spend 6 or more hours on science lessons, as the beta coefficient has the huge value of .17. Clearly, the time spent on regular lessons in math and science is a powerful factor for determining student achievement in both subjects.

Out of school time lessons looks at hours spent beyond the regular school time with a teacher. The expectation for this variable is that additional time spent studying the material in structured lessons should improve scores. However, the results for both math and science out of school lessons all have negative effects. This could be due to the fact that only students that are struggling in school sign up for these types of lessons. Looking at the variable for math out of school lessons there is a generally constant negative effect, with a beta coefficient of -.04, from attending any number of lessons in both the math and science regressions. The effect seemed to be less damaging for students participating in 6 or more hours of out of school lessons in math.

	Math			Science		
Math Out of School Lessons	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Less than 2 hours	-9.724369	.4243659	-.0468617	-9.809069	.4423405	-.0469086
2 to 4 hours	-13.06592	.5694763	-.0484246	-14.33611	.5935972	-.0527261
4 to 6 hours	-20.51434	.9301137	-.0429488	-22.14536	.9695099	-.0460091
6 or more hours	-18.56746	1.501481	-.022958	-21.18037	1.565078	-.0259886

The story is similar for the science out of school lessons as the effect is negative and the math and science regressions are almost identical. The effect is important as it has a negative beta coefficient of -.04 for science lessons less than 4 hours outside of school. However, there is a diminishing negative impact for science out of school lessons that are in excess of 4 hours as the beta coefficients become -.02 and -.01, relatively moderate in their effect.

	Math			Science		
Science Out of School Lessons	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Less than 2 hours	-9.203151	.4393685	-.0422463	-9.838004	.4579785	-.0448154
2 to 4 hours	-14.19804	.6481985	-.0438198	-15.0337	.6756538	-.0460443
4 to 6 hours	-16.27858	1.153992	-.0260832	-16.69422	1.202871	-.0265448
6 or more hours	-15.90102	1.955658	-.0144298	-16.26509	2.038493	-.0146474

Thus it seems that out of school lessons is a negative quality, which suggests that these lessons attract students that could be struggling with their courses and need the guidance.

The next indicator examines the benefits of self study in math and science. Commonly, self study suggests a positive effect upon a student's performance as it allows the student to review and absorb the material. There are benefits to conducting studying alone also as students have the opportunity to make sense out of the lesson material from the classroom and reason the facts in such a way that they can better understand the underlying concepts. In the regression model examining the effect of self study of math, overall the time spent studying math has a positive impact upon a student's achievement scores in both math and sciences. This positive benefit to both areas of study shows again the spillover effects from one subject to the other.

	Math			Science		
Math Self Study	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Less than 2 hours	9.059628	.5854009	.0476855	8.200069	.6101963	.0428313
2 to 4 hours	13.39506	.6659091	.0625142	11.28291	.6941145	.0522544
4 to 6 hours	11.84975	.8589786	.0342809	8.682637	.8953618	.0249266
6 or more hours	14.9617	1.168457	.0278391	9.390802	1.217949	.0173398

The optimal period of math self study in the math and science regressions appears to be 2 to 4 hours as they have the highest beta coefficients. These effects are important as beta coefficients of .06 and .05 have palpable impacts upon student performance. Studying more than 4 hours has smaller returns as the extended period self studying of math does not derive higher achievement scores.

In the case of science self study the results for the impact upon students scores in math and science differ as the effect upon science scores is stronger than for math scores.

	Math				Science		
Science Self Study	Coefficient	Standard Error	p-value	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
Less than 2 hours	7.150788	.5116006	0.000	.0376364	9.389546	.5332702	.0490418
2 to 4 hours	3.86267	.6344954	0.000	.0166669	8.99686	.6613703	.0385235
4 to 6 hours	.4286275	.8982664	0.633	.0010736	7.376966	.9363136	.0183356
6 or more hours	-3.939108	1.301351	0.002	-.0061175	3.689858	1.356471	.0056866

For both math and science regressions the most beneficial time of science self study is less than 2 hours as this produces beta coefficients of .037 and .049 for math and science respectively. However, for the higher values of self study the positive impact of self study diminishes, more rapidly than it did for math self study. The indicator for “4 to 6 hours” in the math regression was statistically insignificant. The lower optimal time for science self study compared to math self study suggests that science requires less self study for a student to succeed than it does for math.

The next group of variables further examines the effect of out of school study which before was shown to have a negative effect upon students achievement scores. These variables compare the effects of 1 on 1 learning, small versus large groups, and teachers from the school versus teachers who are not. As expected, regardless of the methods of out of school study, the effect of all of these indicators has a negative effect upon student performance. Looking at the beta coefficients for the math and science regressions it appears that the impacts of all of these methods for out of school lessons have relatively the same negative impacts on math and science scores. The two most disadvantageous methods of lesson outside of school were those with a teacher from the school in either small or large groups as this had the largest beta coefficient of -.05. The results are listed in the table below:

	Math			Science		
Out of School Lessons	Coefficient	Standard Error	Beta Coefficient	Coefficient	Standard Error	Beta Coefficient
1 on 1 lesson	-8.440592	.4283453	-.0366847	-8.248857	.4464885	-.0355774
Small Group Lesson (<8) with teacher from school	-14.65869	.4979752	-.0545198	-14.81199	.5190676	-.054669
Small Group Lesson (<8) with teacher not from school	-3.589781	.5293324	-.0128142	-4.202155	.5517529	-.0148856
Large Group Lesson (≥8) with teacher from school	-12.43976	.4638923	-.0501246	-13.15852	.4835411	-.0526155
Large Group Lesson (≥8) with teacher not from school	-3.378251	.5563957	-.011252	-5.548837	.5799625	-.0183403

A possible explanation for this outcome is that students could benefit more from a teacher not from the school as this exposes them to different teaching methods and it is clear that non-school teachers have beta coefficients that are a third the size, only about -.015. A surprising result from this regression is that 1 on 1 had a moderate negative effect, even though many people strongly believe in the power of individual teaching as being most effective in light of the direct attention to the student. Again, this can be attributed to the fact that the majority of students with personal tutors need assistance as they struggle in school.

This regression analysis upon the most important drivers in the category of learning approaches reveals clear features that dominate the impact upon achievement scores in math and science. Students who consider it very important to perform well in math or science had among the highest impact upon their performance scores. The beta coefficients for the variables looking at the importance of doing well in were .13 for math and .17 for science. Through the course of this section it has also become apparent that there are optimal amounts of lesson and study time. For regular math lessons the optimal amount of instruction per week is 4 to 6 hours, while for regular science lessons it was 6 or more hours. These results for class lessons could be implemented by schools to guide their instruction and allocation of time in order to have a more efficient system of teaching. Out of school study and the associated methods had negative effects upon achievement scores and the variables seem to capture a specific set of students who actually struggle and thus require more assistance learning. Self study had moderate benefits as long as the duration of study was less than 2 hours. Thus using these models trends a student could also consider focusing their time allocation for effective studying to derive the best outcomes.

Classroom Features

Students are greatly affected by their classroom environment which consists of mainly their peers. An OECD publication mentions how "class size is a hotly debated topic in many OECD countries. While smaller classes are often perceived as enabling a higher quality of education, evidence on the impact of class size on student performance is mixed" (*Highlights* 70). This section will examine the validity of the claims about class sizes and look at the effects of ability grouping as both of these variables largely shape a student's learning environment.

Class size is one of the most commonly talked about factors in schools and many people consider smaller class sizes to be very important due to greater student attention. The model includes a multiple choice category for the different class sizes instead of a raw number because this approach allows for the examination of different groups of class sizes in case the effect is nonlinear. The groups of class sizes are divided into groups of 5 such as 16 to 20, 21 to 25, 26 to 30, all the way up to 50 and also one for classes with more than 50 students. These variables describe the benefit of these class sizes relative to the omitted variable of classes with 15 or fewer students. Below are the math and science regression analysis results:

	Math				Science			
Class Size	Coefficient	Standard Error	p-value	Beta Coefficient	Coefficient	Standard Error	p-value	Beta Coefficient
16 to 20	-1.172609	.8878141	0.187	-.0038747	-1.263108	.9254186	0.172	-.0041419
21 to 25	-.2806701	.8249372	0.734	-.0012876	-.1709319	.8598785	0.842	-.0007782
26 to 30	3.230285	.8460816	0.000	.0145	3.746252	.8819185	0.000	.0166876
31 to 35	6.434139	.9635181	0.000	.0209996	5.754042	1.004329	0.000	.0186364
36 to 40	3.907755	1.095002	0.000	.0117433	4.383111	1.141383	0.000	.0130711
41 to 45	7.052117	1.164187	0.000	.0169802	7.581137	1.213498	0.000	.0181144
46 to 50	-.8883678	1.271323	0.485	-.0017642	-2.228046	1.325172	0.093	-.0043909
More than 50	1.038094	1.096525	0.344	.0024727	-2.311917	1.14297	0.043	.0054647

Class sizes consisting of 16 to 20 students and 21 to 25 students were statistically insignificant in both the math and science regressions. For class sizes in the ranges of 26 to 30, 31 to 35, 36 to 40, and 41 to 45, there was a moderate benefit to being in a class of these sizes as opposed one with 15 or fewer students as the beta coefficient was .01 and .02 for the math and science achievement scores. This indicates that students perform better in classes of a larger size compared to the smallest class sizes. A possible explanation for this is that in the class with 21 to 40 students there exist positive peer effects, in which the greater number of students facilitates more effective learning as students learn from their peers in addition to the teacher. Another reason for the small classes of 15 or fewer students not faring as well could stem from the fact that theses are schools are smaller in general and thus have less resources and in effect, student performance falls. The largest class sizes of 46 to 50 and 50 or more students are all statistically insignificant, expect for the science regression of 50 or more students. However, the very small beta coefficient on this indicator shows that it has a negligible effect upon student achievement scores, which seems to refute the benefits of small class sizes. The impact of class sizes is indeed mixed in its effects and not clearly in favor of small class sizes as one would expect.

A related feature of the classroom environment is ability grouping both within and between classes. Ability grouping is where certain students are grouped with students of a similar skill level. This can occur between classes, in which students of a particular level all attend one class and are in a sense separated from the other students. Ability grouping can also occur within classes where the students are divided into groups in the classroom based upon ability. The model considers whether ability grouping in some subjects or all subjects affects achievement scores relative to the omitted variable in which there is no ability grouping. This effect should actually be detrimental to the student achievement scores because although the higher performing students could benefit from increased interaction with intelligent peers, the rest of the student population suffers as a result of the decreased interaction with intelligent peers. The PISA scores of the model represent an average of scores over all students. Therefore a decrease in the regular students' scores should outweigh the gains in the gifted students' scores

The results from the regression analysis support the predicted effects of ability grouping as all of the coefficients are negative.

Test Type	Ability Grouping	Extent	Coefficient	Standard Error	p-value	Beta Coefficient
Math	Between classes	All Subjects	-1.724006	.6104227	0.005	-.0053988
		Some Subjects	-1.148558	.441678	0.009	-.0056911
	Within classes	All Subjects	-.4109041	.6809286	0.546	-.0011735
		Some Subjects	-1.99625	.3773008	0.000	-.0102763
Science	Between classes	All Subjects	-.9844259	.636278	0.122	-.0030592
		Some Subjects	-.2541989	.4603859	0.581	-.0012499
	Within classes	All Subjects	-.8482553	.7097702	0.232	-.002404
		Some Subjects	-2.293592	.3932819	0.000	-.0117167

However, it seems that the affects of ability grouping in general are minute as the majority of the beta coefficients are all less than -.01. In the math regression, the effect of ability grouping between classes has a minor effect reducing scores. While, in the science regression for ability grouping between classes is statistically insignificant. Ability grouping within classes for all subjects is also statistically insignificant for both the math and science regressions. Lastly, ability grouping for some subjects within classes had a small effect, beta coefficient of -.01, upon math and science achievement scores. Thus it seems that ability grouping has a relatively small impact upon students' scores that is almost negligible.

Overall the variables that contribute to classroom features happen to have some of the smallest effects in comparison to the beta coefficients of other variables included in the model.

Country Comparison

One of the most common standards of success of an educational system is measured by comparing academic performance relative to other countries. The regression model includes country dummy variables for each of the countries included in the regression. These variables help account for factors of the regression that are specifically related to being a part of that country. Part of the challenge associated with interpreting these indicators is that the single dummy variable can represent a number of different driving forces such as industrialization, wealth, immigration, taxes, and government policies. However, it is possible to see clear distinctions between the different countries and how students in one country perform compared with another. In the model the omitted variable is the U.S., therefore all of the dummy country indicators show achievement relative to the U.S.

Looking at the math regression in the Regression Tables section, it seems that most of the European countries have positive beta coefficients, indicating that they perform better than the

U.S. Most of Latin America and less industrialized nations have negative beta coefficients. The countries with the highest beta coefficients include: Finland (.09), Switzerland (.10), Hong Kong (.13), and Chinese Taipei (.17). Finland is an interesting case as its unique educational system manages to top the charts and receive a fair amount of positive coverage. They have extremely high achievement scores despite the fact that:

> "The Finns spend a meager (compared to the U.S. and Canada) $5,000 a year per student, operate no gifted programs, have average class sizes close to 30, and don't begin schooling children until they are 7." (Gardner 30)

This is interesting as it appears that Finland has an effective method for deriving the most out of their unique and unconventional educational system that other countries could learn from. While Columbia (-.05), Brazil (-.05), and Qatar (-.07) had the lowest beta coefficients. For Columbia and Brazil this is reasonable since those countries are continuing to develop their infrastructure and are among the mid-sized industrialized countries that are not as wealthy as the top performing countries. However the outcome for Qatar is surprising as it is a wealthy industrialized nation whose "ruler, Sheikh Hamad bin Khalifa Al-Thani, set up the Qatar Foundation, a multibillion-dollar endowment to fully finance universities that agree to open branches in a complex called Education City (Krieger). Thus the shortcoming of educational performance are mostly likely not due to funding, rather they could be attributed to characteristics of the educational system in general.

In the science regression the trend is very much the same. The countries with the strongest performance in science are again Finland, Hong Kong, and Chinese Taipei. While the poor performing countries relative to the U.S. are the same ones from the math regression and additionally Mexico and Thailand. Mexico has the lowest beta coefficient of -.08 for science achievement scores. This country comparison implies that there is something to be learned from a deeper analysis of the countries that are top performers in math and science, in order to comprehend whether their successful results are due to characteristics of their educational system or other country specific qualities.

Implications about Educational Drivers

This paper examined numerous variables with the intent of better understanding the drivers of education and their relative magnitudes as measured by the beta coefficients. The regression analysis confirmed the importance of parent education and working classification as key characteristics from a student's family background that largely influences the student's education and performance. Essential resources for student success were clearly computers and books. School characteristics had a mild impact on performance that was weak compared to the other factors. Some myths were dispelled such as the strong importance of class size. Although smaller classes are conducive to individual benefits, the regression shows that the effect of class size is moderate relative to the other strong indicators. The main drivers of education in both the math and science regression analyses with the highest beta coefficients were: the number of books owned, importance of doing well in math, and the duration of regular lessons in math and science. These variables all had beta coefficients that were in excess of 0.13, which is quite large. This overall regression analysis provides students, educations, and policy makers with criteria about what drives educational achievement that way they can look to these drivers and try to increase their optimal academic performance by setting up for successful education.

Regression Tables

Table A: Regression of Math Scores versus All Drivers of Education[1]

Source	Sum of Squares	Degrees of Freedom	Mean Squares
Model	802011285	171	4690124.48
Residual	712944012	167713	4250.97644
Total	1.5150e+09	167884	9023.82179

Overall Model Fit	
Number of Observations	= 167885
F(171,167713)	= 1103.31
Prob > F	= 0.0000
R-squared	= 0.5294
Adj R-squared	= 0.5289
Root MSE	= 65.2

Category	**Question**	**Variable**	**Coefficient**	**Standard Error**	**t-statistic**	**p-value**	**Beta Coefficient**
Family Background	Parent Pressure on School	Majority	3.794127	.5215844	7.27	0.000	.016244
		Small Group	-.835124	.4105879	-2.03	0.042	-.0043944
	Mother's Top ISCED Level Completed	3A	13.34388	1.0783	12.37	0.000	.0702137
		3B/3C	8.805905	1.121924	7.85	0.000	.0365099
		2	4.597191	1.062004	4.33	0.000	.0184182
		1	2.303337	1.077629	2.14	0.033	.0067685
	Father's Top ISCED Level Completed	3A	14.50955	1.092149	13.29	0.000	.076351
		3B/3C	9.762505	1.126821	8.66	0.000	.0424856
		2	5.760177	1.083235	5.32	0.000	.0232895
		1	4.319418	1.116718	3.87	0.000	.0123945
	Highest Parent's Work Classification	White Collar High	17.38657	.6266419	27.75	0.000	.0912573
		White Collar Low	5.955759	.6421108	9.28	0.000	.0262991
		Blue Collar High	2.365248	.6768011	3.49	0.000	.0086529
	Born in Country	Self	5.628278	.8595559	6.55	0.000	.01329
		Mother	-.6903371	.7004746	-0.99	0.324	-.0023595
		Father	2.061462	.6919046	2.98	0.003	.0069909
	Language Spoken at Home	Language of Test	9.868693	1.04767	9.42	0.000	.0333552
		Other National Language	8.453492	1.219153	6.93	0.000	.0245593
	Gender	Male	20.40598	.3267143	62.46	0.000	.1073726
Learning Resources	Computer Ratio	Ratio of Computer to School Size	1.200427	1.127873	1.06	0.287	.0022759
	Possessions	Desk to study at home	2.934474	.6300064	4.66	0.000	.0087522
		Own room	.3803714	.453705	0.84	0.402	.0015752
		Quiet place to study	1.380443	.5368931	2.57	0.010	.0046792
		Computer to study	13.34807	.9469382	14.10	0.000	.0541992
		Educational software	-1.576333	.377221	-4.18	0.000	-.0082784
		Internet connection	10.54826	.5232222	20.16	0.000	.0504632
		Own calculator	7.79397	.6712755	11.61	0.000	.021589
		Classic Literature	10.13522	.4025321	25.18	0.000	.0528094

[1] These Regressions were performed using the PISA 2006 School and Student Data. The statistical regressions were calculated using the program Stata.

		Books of poetry	-1.86982	.3926185	-4.76	0.000	-.0097656
		Works of art	-.7421089	.3669943	-2.02	0.043	-.0038149
		Books to assist in school work	3.424956	.5257146	6.51	0.000	.0119101
		Dishwasher	8.445312	.9837151	8.59	0.000	.0152219
		A DVD or VCR	-2.826157	.6487592	-4.36	0.000	-.0083604
	Number of Cell Phones	One	1.347536	1.013305	1.33	0.184	.0038753
		Two	6.122852	1.00478	6.09	0.000	.0219079
		Three or More	5.742271	.9953146	5.77	0.000	.0263749
	Number of Televisions	One	.9983782	1.720501	0.58	0.562	.004174
		Two	-3.455305	1.736034	-1.99	0.047	-.0173647
		Three or More	-10.03766	1.747607	-5.74	0.000	-.0524884
	Number of Computers	One	6.691064	.9899692	6.76	0.000	.0351876
		Two	12.82446	1.06899	12.00	0.000	.0559662
		Three or More	19.28549	1.132216	17.03	0.000	.0696434
	Number of Cars	One	4.146572	.555445	7.47	0.000	.0209636
		Two	3.887393	.6230153	6.24	0.000	.0190823
		Three or More	-2.933548	.7232805	-4.06	0.000	-.0109133
	Number of Books	11 to 25	5.083856	.6164921	8.25	0.000	.020146
		26 to100	19.38492	.6025598	32.17	0.000	.0941492
		101 to 200	31.06791	.6866611	45.24	0.000	.1259452
		201 to 500	44.85196	.7472086	60.03	0.000	.164316
		More than 500	47.79136	.8554935	55.86	0.000	.1353502
School Characteristics	Achievement Scores	Listed Publicly	3.027201	.3882834	7.80	0.000	.0153636
		Principal Eval	-.864921	.4522119	-1.91	0.056	-.004305
		Teacher Eval	-2.720449	.4421258	-6.15	0.000	-.0143179
		Tracked over Time	-.4254099	.4027612	-1.06	0.291	-.002083
	Other Schools Available	Two or More	.1274827	.4382035	0.29	0.771	.0006475
		One Other	.318715	.5635288	0.57	0.572	.0011755
	Academic Requirement	Prerequisite	11.91255	.5516788	21.59	0.000	.050878
		High Priority	4.930898	.6338805	7.78	0.000	.0158986
		Considered	3.479139	.4612335	7.54	0.000	.0154923
	Science Activity	Clubs	1.997223	.4036248	4.95	0.000	.0104711
		Fairs	.7877487	.3994854	1.97	0.049	.0041438
		Competitions	1.368788	.4284937	3.19	0.001	.0070424
		Extracurricular Projects	1.454157	.3804412	3.82	0.000	.0076231
		Excursions	-.7263795	.6121038	-1.19	0.235	-.0023732
	General Activity	Outdoor Education	.7556329	.4230762	1.79	0.074	.0034578
		Museum Trips	-.2568682	.4529486	-0.57	0.571	-.0011746
		Trip to Sci/tech centers	-.1837413	.4284749	-0.43	0.668	-.0008979
		Guest Speakers	1.064545	.3933464	2.71	0.007	.005452
	Apprenticeship	Half or Less	-1.744897	.5202178	-3.35	0.001	-.006443
		More than Half	-5.501848	.6521398	-8.44	0.000	-.0198689
	Industry Influence	Minor	-.7702786	.3875349	-1.99	0.047	-.0040534
		Considerable	-2.961865	.5982704	-4.95	0.000	-.0104049

Approaches to Learning	Importance of doing Well in Science	Very Important	22.83479	.9491747	24.06	0.000	.1127864
		Important	14.63806	.914199	16.01	0.000	.0766225
		Little Importance	5.990692	.9312046	6.43	0.000	.0245872
	Importance of doing Well in Math	Very Important	26.97421	1.456385	18.52	0.000	.1396609
		Important	19.13428	1.454602	13.15	0.000	.094654
		Little Importance	9.81778	1.538508	6.38	0.000	.0259017
	Science Regular Lessons	Less than 2 hours	2.136326	.702464	3.04	0.002	.0092648
		2 to 4 hours	17.89542	.7077405	25.29	0.000	.090902
		4 to 6 hours	33.89071	.7751477	43.72	0.000	.1456693
		6 or more hours	52.19169	.862753	60.49	0.000	.1760268
	Science Out of School Study	Less than 2 hours	-9.203151	.4393685	-20.95	0.000	-.0422463
		2 to 4 hours	-14.19804	.6481985	-21.90	0.000	-.0438198
		4 to 6 hours	-16.27858	1.153992	-14.11	0.000	-.0260832
		6 or more hours	-15.90102	1.955658	-8.13	0.000	-.0144298
	Science Self Study	Less than 2 hours	7.150788	.5116006	13.98	0.000	.0376364
		2 to 4 hours	3.86267	.6344954	6.09	0.000	.0166669
		4 to 6 hours	.4286275	.8982664	0.48	0.633	.0010736
		6 or more hours	-3.939108	1.301351	-3.03	0.002	-.0061175
	Math Regular Lessons	Less than 2 hours	2.637888	1.176259	2.24	0.025	.0089994
		2 to 4 hours	24.76854	1.141529	21.70	0.000	.1246345
		4 to 6 hours	31.21778	1.155669	27.01	0.000	.1601802
		6 or more hours	22.94199	1.247264	18.39	0.000	.0771067
	Math Out of School Study	Less than 2 hours	-9.724369	.4243659	-22.92	0.000	-.0468617
		2 to 4 hours	-13.06592	.5694763	-22.94	0.000	-.0484246
		4 to 6 hours	-20.51434	.9301137	-22.06	0.000	-.0429488
		6 or more hours	-18.56746	1.501481	-12.37	0.000	-.022958
	Math Self Study	Less than 2 hours	9.059628	.5854009	15.48	0.000	.0476855
		2 to 4 hours	13.39506	.6659091	20.12	0.000	.0625142
		4 to 6 hours	11.84975	.8589786	13.80	0.000	.0342809
		6 or more hours	14.9617	1.168457	12.80	0.000	.0278391
	Out of School Lessons	1 on 1 lesson	-8.440592	.4283453	-19.71	0.000	-.0366847
		Small Group Lesson (<8) with teacher from school	-14.65869	.4979752	-29.44	0.000	-.0545198
		Small Group Lesson (<8) with teacher not from school	-3.589781	.5293324	-6.78	0.000	-.0128142
		Large Group Lesson (≥8) with teacher from school	-12.43976	.4638923	-26.82	0.000	-.0501246
		Large Group Lesson (≥8) with teacher not from school	-3.378251	.5563957	-6.07	0.000	-.011252
Class Features	Class Size (students)	16 to 20	-1.172609	.8878141	-1.32	0.187	-.0038747
		21 to 25	-.2806701	.8249372	-0.34	0.734	-.0012876
		26 to 30	3.230285	.8460816	3.82	0.000	.0145
		31 to 35	6.434139	.9635181	6.68	0.000	.0209996
		36 to 40	3.907755	1.095002	3.57	0.000	.0117433

		41 to 45	7.052117	1.164187	6.06	0.000	.0169802
		46 to 50	-.8883678	1.271323	-0.70	0.485	-.0017642
		more than 50	1.038094	1.096525	0.95	0.344	.0024727
	Ability grouping between classes	All Subjects	-1.724006	.6104227	-2.82	0.005	-.0053988
		Some Subjects	-1.148558	.441678	-2.60	0.009	-.0056911
	Ability grouping within classes	All Subjects	-.4109041	.6809286	-0.60	0.546	-.0011735
		Some Subjects	-1.99625	.3773008	-5.29	0.000	-.0102763
Country Indicators	Country Dummies	Argentina	-35.14023	2.221638	-15.82	0.000	-.0344863
		Australia	30.94275	1.518957	20.37	0.000	.062799
		Austria	40.28893	1.941963	20.75	0.000	.052637
		Azerbaijan	(dropped)				
		Belgium	54.9838	1.748974	31.44	0.000	.0838454
		Bulgaria	(dropped)				
		Brazil	-42.61812	1.966828	-21.67	0.000	-.0561266
		Canada	22.71013	1.37834	16.48	0.000	.0587544
		Switzerland	56.99757	1.680517	33.92	0.000	.1061587
		Chile	-30.50601	2.115245	-14.42	0.000	-.0335158
		Columbia	-59.47452	2.398153	-24.80	0.000	-.0543327
		Czech Republic	43.5267	1.70773	25.49	0.000	.0718265
		Germany	33.78732	2.117772	15.95	0.000	.0369217
		Denmark	37.56728	2.167815	17.33	0.000	.0394087
		Spain	25.6126	1.491329	17.17	0.000	.06455
		Estonia	19.12858	1.848766	10.35	0.000	.0255601
		Finland	69.22318	1.900335	36.43	0.000	.0979016
		France	(dropped)				
		United Kingdom	16.54737	1.621569	10.20	0.000	.0306822
		Greece	10.32522	1.987269	5.20	0.000	.0126402
		Hong Kong	90.50834	2.022908	44.74	0.000	.1316121
		Croatia	9.463248	1.963979	4.82	0.000	.0121297
		Hungary	25.74149	1.884537	13.66	0.000	.0348544
		Indonesia	-35.22098	2.123761	-16.58	0.000	-.0482914
		Ireland	32.69102	2.041914	16.01	0.000	.0343236
		Iceland	12.60912	1.98394	6.36	0.000	.0145427
		Israel	-6.266576	2.265286	-2.77	0.006	-.0058722
		Italy	14.32148	1.559197	9.19	0.000	.0321681
		Jordan	-42.90635	2.070209	-20.73	0.000	-.0486642
		Japan	43.86321	1.830087	23.97	0.000	.073954
		Kyrgyzstan	-73.43479	2.520928	-29.13	0.000	-.0620021
		Korea	52.29452	1.97027	26.54	0.000	.0672641
		Liechtenstein	55.18494	4.735638	11.65	0.000	.0208242
		Lithuania	23.25186	1.839386	12.64	0.000	.0321067
		Luxembourg	22.19435	2.049406	10.83	0.000	.0273676
		Latvia	18.77034	2.059727	9.11	0.000	.022151
		Macao	65.39931	2.354792	27.77	0.000	.0717555

		Mexico	-17.05485	1.588818	-10.73	0.000	-.0442048
		Montenegro	-52.12386	2.807528	-18.57	0.000	-.0381148
		Netherlands	64.17484	2.102917	30.52	0.000	.0706006
		Norway	11.2023	1.884113	5.95	0.000	.014448
		New Zealand	37.61288	1.89138	19.89	0.000	.0448257
		Poland	(dropped)				
		Portugal	12.54986	2.049087	6.12	0.000	.01404
		Qatar	-120.8605	3.134361	-38.56	0.000	-.0722405
		Romania	-21.92469	2.012975	-10.89	0.000	-.0268518
		Russian Federation	17.19643	1.991511	8.63	0.000	.0207292
		Serbia	-17.47757	2.084338	-8.39	0.000	-.0208339
		Slovakia	31.0669	1.891179	16.43	0.000	.0409668
		Slovenia	19.99228	1.748908	11.43	0.000	.031343
		Sweden	20.73687	1.822352	11.38	0.000	.0282824
		Chinese Taipei	87.43204	1.730688	50.52	0.000	.1775763
		Thailand	-21.56169	1.841343	-11.71	0.000	-.0372175
		Tunisia	-34.72567	2.948094	-11.78	0.000	-.0230301
		Turkey	-13.97515	1.994566	-7.01	0.000	-.0177163
		Uruguay	-1.748286	2.14101	-0.82	0.414	-.0018123
Intercept		_cons	263.2638	3.353494	78.50	0.000	.

Table B: Regression of Science Scores versus All Drivers of Education

Source	Sum of Squares	Degrees of Freedom	Mean Squares
Model	763762179	171	4466445.49
Residual	774618419	167713	4618.71422
Total	1.5384e+09	167884	9163.35445

Overall Model Fit	
Number of Observations	= 167885
F(171,167713)	= 967.03
Prob > F	= 0.0000
R-squared	= 0.4965
Adj R-squared	= 0.4960
Root MSE	= 67.961

Category	Question	Variable	Coefficient	Standard Error	t-statistic	p-value	Beta Coefficient
Family Background	Parent Pressure on School	Majority	3.030178	.5436768	5.57	0.000	.0128741
		Small Group	-.5279292	.4279789	-1.23	0.217	-.0027567
	Mother's Top ISCED Level Completed	3A	14.50782	1.123973	12.91	0.000	.0757548
		3B/3C	9.818568	1.169445	8.40	0.000	.0403974
		2	4.825233	1.106987	4.36	0.000	.0191841
		1	2.827996	1.123273	2.52	0.012	.0082468
	Father's Top ISCED Level Completed	3A	14.57126	1.138408	12.80	0.000	.0760897
		3B/3C	10.35604	1.174549	8.82	0.000	.0447241
		2	5.429938	1.129117	4.81	0.000	.0217865
		1	4.924018	1.164018	4.23	0.000	.0140214
	Highest Parent's	White Collar High	18.04896	.6531842	27.63	0.000	.09401

	Work Classification	White Collar Low	6.350619	.6693082	9.49	0.000	.0278283
		Blue Collar High	2.878698	.7054679	4.08	0.000	.0104508
	Born in Country	Self	4.62868	.8959635	5.17	0.000	.0108461
		Mother	.3455719	.7301441	0.47	0.636	.0011721
		Father	2.980106	.7212111	4.13	0.000	.010029
	Language Spoken at Home	Language of Test	22.88102	1.092046	20.95	0.000	.0767444
		Other National Language	16.65765	1.270791	13.11	0.000	.0480243
	Gender	Male	11.91407	.3405527	34.98	0.000	.0622106
Learning Resources	Computer Ratio	Ratio of Computer to School Size	3.238275	1.175645	2.75	0.006	.0060925
	Possessions	Desk to study at home	2.374024	.6566912	3.62	0.000	.0070265
		Own room	.3183608	.4729223	0.67	0.501	.0013084
		Quiet place to study	.9507099	.5596339	1.70	0.089	.0031979
		Computer to study	13.39536	.987047	13.57	0.000	.0539755
		Educational software	-3.564008	.3931987	-9.06	0.000	-.0185741
		Internet connection	9.671316	.5453839	17.73	0.000	.0459143
		Own calculator	6.81349	.6997083	9.74	0.000	.0187288
		Classic Literature	12.92527	.4195819	30.81	0.000	.0668322
		Books of poetry	.2960494	.4092484	0.72	0.469	.0015344
		Works of art	.3115289	.3825389	0.81	0.415	.0015892
		Books to assist in school work	2.905847	.5479819	5.30	0.000	.0100277
		Dishwasher	7.673553	1.025382	7.48	0.000	.0137252
		A DVD or VCR	-3.053644	.6762383	-4.52	0.000	-.0089643
	Number of Cell Phones	One	.2907021	1.056225	0.28	0.783	.0008296
		Two	5.217205	1.047339	4.98	0.000	.0185248
		Three or More	2.759394	1.037472	2.66	0.008	.0125774
	Number of Televisions	One	2.848883	1.793375	1.59	0.112	.0118196
		Two	-2.959344	1.809566	-1.64	0.102	-.0147586
		Three or More	-11.47297	1.821629	-6.30	0.000	-.0595354
	Number of Computers	One	7.277059	1.031901	7.05	0.000	.0379768
		Two	12.70762	1.114269	11.40	0.000	.0550324
		Three or More	19.01767	1.180173	16.11	0.000	.0681514
	Number of Cars	One	2.321215	.5789716	4.01	0.000	.0116455
		Two	1.364255	.649404	2.10	0.036	.0066456
		Three or More	-6.502883	.753916	-8.63	0.000	-.0240069
	Number of Books	11 to 25	6.663137	.6426044	10.37	0.000	.0262025
		26 to100	20.23074	.628082	32.21	0.000	.0975063
		101 to 200	33.90935	.7157455	47.38	0.000	.1364135
		201 to 500	46.07068	.7788576	59.15	0.000	.1674908
		More than 500	49.83354	.891729	55.88	0.000	.1400552
	Achievement Scores	Listed Publicly	2.643272	.4047296	6.53	0.000	.0133125
		Principal Eval	-1.43862	.471366	-3.05	0.002	-.0071058
		Teacher Eval	-2.762685	.4608526	-5.99	0.000	-.0144291

School Characteristics		Tracked over Time	.3627631	.4198207	0.86	0.388	.0017627
	Other Schools Available	Two or More	.8270144	.4567641	1.81	0.070	.0041687
		One Other	.4441684	.5873978	0.76	0.450	.0016257
	Academic Requirement	Prerequisite	10.62718	.5750458	18.48	0.000	.0450414
		High Priority	4.98254	.6607293	7.54	0.000	.0159423
		Considered	3.230005	.4807696	6.72	0.000	.014273
	Science Activity	Clubs	2.791483	.4207209	6.64	0.000	.0145234
		Fairs	.2712387	.4164061	0.65	0.515	.0014159
		Competitions	.6353282	.4466432	1.42	0.155	.0032438
		Extracurricular Projects	.6094111	.3965553	1.54	0.124	.0031703
		Excursions	.9516244	.6380303	1.49	0.136	.0030854
	General Activity	Outdoor Education	1.323015	.4409962	3.00	0.003	.0060079
		Museum Trips	.1355191	.4721338	0.29	0.774	.0006149
		Trip to Sci/tech centers	-.4997484	.4466235	-1.12	0.263	-.0024234
		Guest Speakers	2.36117	.4100071	5.76	0.000	.0120002
	Apprenticeship	Half or Less	-.6587917	.5422523	-1.21	0.224	-.002414
		More than Half	-3.952882	.6797621	-5.82	0.000	-.014166
	Industry Influence	Minor	-.6232248	.4039494	-1.54	0.123	-.0032545
		Considerable	-3.554426	.6236109	-5.70	0.000	-.0123912
Approaches to Learning	Importance of doing Well in Science	Very Important	34.78256	.9893782	35.16	0.000	.1704862
		Important	23.03737	.9529211	24.18	0.000	.1196668
		Little Importance	10.39264	.9706469	10.71	0.000	.0423279
	Importance of doing Well in Math	Very Important	10.9836	1.518072	7.24	0.000	.0564337
		Important	7.534108	1.516214	4.97	0.000	.0369851
		Little Importance	4.77484	1.603674	2.98	0.003	.0125009
	Science Regular Lessons	Less than 2 hours	2.690851	.7322178	3.67	0.000	.0115804
		2 to 4 hours	18.02388	.7377178	24.43	0.000	.0908548
		4 to 6 hours	34.5732	.8079801	42.79	0.000	.1474671
		6 or more hours	51.43454	.899296	57.19	0.000	.1721473
	Science Out of School Study	Less than 2 hours	-9.838004	.4579785	-21.48	0.000	-.0448154
		2 to 4 hours	-15.0337	.6756538	-22.25	0.000	-.0460443
		4 to 6 hours	-16.69422	1.202871	-13.88	0.000	-.0265448
		6 or more hours	-16.26509	2.038493	-7.98	0.000	-.0146474
	Science Self Study	Less than 2 hours	9.389546	.5332702	17.61	0.000	.0490418
		2 to 4 hours	8.99686	.6613703	13.60	0.000	.0385235
		4 to 6 hours	7.376966	.9363136	7.88	0.000	.0183356
		6 or more hours	3.689858	1.356471	2.72	0.007	.0056866
	Math Regular Lessons	Less than 2 hours	2.078901	1.226081	1.70	0.090	.0070382
		2 to 4 hours	24.06995	1.18988	20.23	0.000	.1201935
		4 to 6 hours	29.56117	1.204619	24.54	0.000	.1505207
		6 or more hours	21.07882	1.300093	16.21	0.000	.0703033
	Math Out of School Study	Less than 2 hours	-9.809069	.4423405	-22.18	0.000	-.0469086
		2 to 4 hours	-14.33611	.5935972	-24.15	0.000	-.0527261
		4 to 6 hours	-22.14536	.9695099	-22.84	0.000	-.0460091

		6 or more hours	-21.18037	1.565078	-13.53	0.000	-.0259886
	Math Self Study	Less than 2 hours	8.200069	.6101963	13.44	0.000	.0428313
		2 to 4 hours	11.28291	.6941145	16.26	0.000	.0522544
		4 to 6 hours	8.682637	.8953618	9.70	0.000	.0249266
		6 or more hours	9.390802	1.217949	7.71	0.000	.0173398
	Out of School Lessons	1 on 1 lesson	-8.248857	.4464885	-18.47	0.000	-.0355774
		Small Group Lesson (<8) with teacher from school	-14.81199	.5190676	-28.54	0.000	-.054669
		Small Group Lesson (<8) with teacher not from school	-4.202155	.5517529	-7.62	0.000	-.0148856
		Large Group Lesson (≥8) with teacher from school	-13.15852	.4835411	-27.21	0.000	-.0526155
		Large Group Lesson (≥8) with teacher not from school	-5.548837	.5799625	-9.57	0.000	-.0183403
Classroom Features	Class Size (students)	16 to 20	-1.263108	.9254186	-1.36	0.172	-.0041419
		21 to 25	-.1709319	.8598785	-0.20	0.842	-.0007782
		26 to 30	3.746252	.8819185	4.25	0.000	.0166876
		31 to 35	5.754042	1.004329	5.73	0.000	.0186364
		36 to 40	4.383111	1.141383	3.84	0.000	.0130711
		41 to 45	7.581137	1.213498	6.25	0.000	.0181144
		46 to 50	-2.228046	1.325172	-1.68	0.093	-.0043909
		more than 50	2.311917	1.14297	2.02	0.043	.0054647
	Ability grouping between classes	All Subjects	-.9844259	.636278	-1.55	0.122	-.0030592
		Some Subjects	-.2541989	.4603859	-0.55	0.581	-.0012499
	Ability grouping within classes	All Subjects	-.8482553	.7097702	-1.20	0.232	-.002404
		Some Subjects	-2.293592	.3932819	-5.83	0.000	-.0117167
Country Indicators	Country Dummies	Argentina	-45.04324	2.315738	-19.45	0.000	-.0438671
		Australia	25.42585	1.583294	16.06	0.000	.0512079
		Austria	28.91703	2.024217	14.29	0.000	.037491
		Azerbaijan	(dropped)				
		Belgium	29.90911	1.823054	16.41	0.000	.0452601
		Bulgaria	(dropped)				
		Brazil	-46.28259	2.050135	-22.58	0.000	-.0604867
		Canada	13.50583	1.436722	9.40	0.000	.0346745
		Switzerland	24.57074	1.751698	14.03	0.000	.0454136
		Chile	-23.66758	2.204839	-10.73	0.000	-.0258039
		Columbia	-69.07045	2.49973	-27.63	0.000	-.0626168
		Czech Republic	26.33745	1.780063	14.80	0.000	.0431291
		Germany	28.06037	2.207473	12.71	0.000	.0304291
		Denmark	5.024255	2.259636	2.22	0.026	.0052302
		Spain	9.157341	1.554496	5.89	0.000	.0229024
		Estonia	17.00544	1.927073	8.82	0.000	.0225494
		Finland	63.12282	1.980826	31.87	0.000	.0885917
		France	(dropped)				

		United Kingdom	18.92014	1.690252	11.19	0.000	.0348137
		Greece	5.353755	2.071442	2.58	0.010	.006504
		Hong Kong	68.73179	2.108591	32.60	0.000	.099182
		Croatia	17.68217	2.047166	8.64	0.000	.0224912
		Hungary	17.65005	1.964359	8.99	0.000	.0237158
		Indonesia	-52.57581	2.213716	-23.75	0.000	-.0715356
		Ireland	28.67378	2.128402	13.47	0.000	.0298757
		Iceland	-16.62783	2.067973	-8.04	0.000	-.0190311
		Israel	-3.545027	2.361235	-1.50	0.133	-.0032966
		Italy	9.574287	1.625239	5.89	0.000	.0213409
		Jordan	-25.43001	2.157896	-11.78	0.000	-.0286222
		Japan	37.33257	1.907603	19.57	0.000	.0624621
		Kyrgyzstan	-93.18787	2.627705	-35.46	0.000	-.0780785
		Korea	6.698117	2.053724	3.26	0.001	.0085496
		Liechtenstein	38.79502	4.936222	7.86	0.000	.0145275
		Lithuania	2.701181	1.917296	1.41	0.159	.0037013
		Luxembourg	6.958336	2.136211	3.26	0.001	.0085147
		Latvia	3.469626	2.14697	1.62	0.106	.0040632
		Macao	35.72164	2.454532	14.55	0.000	.0388939
		Mexico	-34.24369	1.656115	-20.68	0.000	-.0880784
		Montenegro	-61.30325	2.926444	-20.95	0.000	-.0444845
		Netherlands	40.78473	2.191989	18.61	0.000	.0445255
		Norway	-7.795345	1.963917	-3.97	0.000	-.0099771
		New Zealand	35.86694	1.971492	18.19	0.000	.0424182
		Poland	(dropped)				
		Portugal	.8177483	2.135879	0.38	0.702	.0009079
		Qatar	-109.4669	3.267121	-33.51	0.000	-.0649303
		Romania	-43.32399	2.098237	-20.65	0.000	-.0526547
		Russian Federation	-.8911021	2.075864	-0.43	0.668	-.001066
		Serbia	-41.32489	2.172623	-19.02	0.000	-.0488842
		Slovakia	7.102549	1.971283	3.60	0.000	.0092943
		Slovenia	16.70384	1.822985	9.16	0.000	.0259874
		Sweden	6.886128	1.89954	3.63	0.000	.00932
		Chinese Taipei	49.45386	1.803993	27.41	0.000	.0996742
		Thailand	-37.51725	1.919335	-19.55	0.000	-.0642633
		Tunisia	-30.06676	3.072964	-9.78	0.000	-.0197879
		Turkey	-35.84394	2.079049	-17.24	0.000	-.0450921
		Uruguay	-19.01479	2.231695	-8.52	0.000	-.0195602
Intercept		_cons	277.5495	3.495535	79.40	0.000	.

Works Cited

Carey, David. "Improving Education Outcomes in Germany". OECD Economics Department Working Papers, No. 611. OECD Publishing, 2008. doi:10.1787/241675712618.

Doyle, Ann. "Educational performance or educational inequality: what can we learn from PISA about France and England?" Compare: A Journal of Comparative Education 38.2 (Mar. 2008): 205-217. Academic Search Complete. EBSCO. Doe Library UC Berkeley, Berkeley, CA. 31 Oct. 2008 <http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=31226272&site=ehost-live>.

Gardner, Walter. "Scandinavian country shows way to education excellence." CCPA Monitor 15.5 (Oct. 2008): 30-30. Academic Search Complete. EBSCO. Doe Library UC Berkeley, Berkeley, CA. 31 Oct. 2008 <http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=34750215&site=ehost-live>.

Krieger, Zvika. “An Academic Building Boom Transforms the Persian Gulf”. The Chronicle of Higher Education. 54.29 (2008).

Marks, Gary N. “Accounting for the gender gaps in student performance in reading and mathematics: evidence from 31 countries”. Oxford Review of Education. 34.1 (2007): 89-109.

OECD. “Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006”. SourceOECD Education & Skills. 11 (2006): 1-192.

OECD. “Highlights from Education at a Glance 2008”. SourceOECD Education & Skills. 3 (2009): 1-100.

OECD. “PISA 2006 School Data Set”. OECD Programme for International Student Assessment (PISA). Doe Library UC Berkeley, Berkeley, CA. 3 Dec. 2008 <www.pisa.oecd.org>.

OECD. “PISA 2006 School Questionnaire”. OECD Programme for International Student Assessment (PISA). Doe Library UC Berkeley, Berkeley, CA. 5 Mar. 2009 <www.pisa.oecd.org>.

OECD. “PISA 2006 Student Data Set”. OECD Programme for International Student Assessment (PISA) Doe Library UC Berkeley, Berkeley, CA. 3 Dec. 2008 <www.pisa.oecd.org>.

OECD. “PISA 2006 Student Questionnaire”. OECD Programme for International Student Assessment (PISA) Doe Library UC Berkeley, Berkeley, CA. 5 Mar. 2009 <www.pisa.oecd.org>.

Papanastasiou, Elena C. and Richard E. Ferdig. “Computer Use and Mathematical Literacy: An Analysis of Existing and Potential Relationships”. Journal of Computers in Mathematics and Science Teaching 25.4 (2006): 361-371.

Park, Hyunjoon. "Public policy and the effect of sibship size on educational achievement: A comparative study of 20 countries." Social Science Research 37.3 (Sep. 2008): 874-887. Academic Search Complete. EBSCO. Doe Library UC Berkeley, Berkeley, CA. 31 Oct. 2008 <http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=32177495&site=ehost-live>.

Siemsen, Hayo and Karl Hayo Siemsen. “Resettling the Thoughts of Ernst Mach and the Vienna Circle in Europe: The Cases of Finland and Germany”. Science & Education. 18.3-4 (2009): 1-25.

UNESCO.org. International Standard Classification of Education ISCED 1997. Nov 1997 <http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm>.