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Introduction

The public's perception of education in America is that it is broken and ineffective, and sometimes seems like it's always been that way. Nearly every president since the 1970s has spoken out about the need to reform our education system. But as with most issues in Washington, politics stood in the way of drastic and necessary action, until after the turn of the century. On January 8th, 2002, President George W. Bush signed into law the No Child Left Behind Act (NCLB), which was intended to usher in a more comprehensive accountability regime, close the achievement gaps between racial and socioeconomic groups, and bring American students to parity with their international peers. Since then, the economic collapse of 2009 brought with it an increased emphasis on policies to grow America's economy, improve its competiveness, and get people back to work. However, in an increasingly computerized and innovation-driven economy, the spotlight has been focused on STEM subjects, science, technology, education, and mathematics, and how today's students are not being taught the skills they need in the modern economy. By 2020, the number of STEM jobs like software developers, medical scientists and engineers are projected to grow more than twice as fast all occupations put together (Ed.gov). Furthermore, only 16% of students graduate high school proficient in mathematics and are interested in STEM jobs, which are being increasingly filled by students from other countries (Ed.gov;Lane & Kinser). President Barack Obama has made the improvement of STEM education a top priority, but the question of how to accomplish this is often the topic of fierce debate between talking heads and politicians.

In this ever-present discussion of education in the United States, a few things that are unquestionably good for students have emerged as common wisdom: more money, more teachers, and smaller class sizes. These are just some of the strategies schools have used in order to meet the required improvements under NCLB. But as education becomes a more salient topic of discussion, many are beginning to wonder whether these things actually have an effect. In January 2009, George Bush further voiced his continuing support for NCLB, stating that he "firmly believe[d] that thanks to [No Child Left Behind], more students are learning." But was he correct? Cynicism and skepticism about American education both abound as the prescribed end of NCLB, 2014, rapidly approaches, with seemingly little progress to show. The purpose of this study is to determine the current state of American STEM education and what, if anything can be done to improve.

Explanation of Testing Procedures

In order to determine the achievement level of students in the United States and internationally, this study will use data from three separate testing programs used to measure educational outcomes in the US as well as around the world. Data specific to the U.S. come from the National Assessment of Educational Progress, or NAEP. The NAEP is a federally mandated, nation-wide exam that was started in 1969 to measure American students' achievement in a wide variety of subjects, such as mathematics, science, reading, writing, and others that are included periodically (Kansky, 1). This study will only focus on science and math education, and will not be using any results related to reading or other subjects.

International testing data comes from two sources: the Programme for International Student Assessment (PISA), and the Trends in International Mathematics and Science Study (TIMSS). PISA is an international survey performed by the Organization for Economic Cooperation and Development (OECD) that was first administered in 2000 and has been

repeated every 3 years since then (Kansky, 2). PISA tests students in OECD member countries (as well as many partner countries) on science, mathematics, and reading, with a focus on a different subject each time it's administered (Kansky, 2). Instead of testing students by grade level, PISA examines students at age 15, no matter what grade they're in. Data for PISA is provided by the OECD itself.

The TIMSS was started by the International Association for the Evaluation of Educational Achievement (IEA) in 1995, and has been performed every four years since then (Kansky, 3). As its name suggests, it exclusively measures achievement in math and science and does not include reading (Kansky, 3). Instead of grouping students by age, as PISA does, TIMSS measures the achievement of both 4th and 8th grade students, similar to the NAEP (Kansky, 3). When it first began in 1995, TIMSS examined high-school students as well, at the end of their education (usually 12th grade). However, this part of the test is no longer performed (as well as most other international tests of high school students) as it became clear that curricula vary much more at that level than at the primary or lower-secondary level, making meaningful international comparisons of high school students nearly impossible. For this reason, all tests used in this study will focus on non-high school, non-tertiary education. TIMSS testing data will be provided for this study by the National Center for Education Statistics.

Though they are sometimes used interchangeably in the press and among the public, there are important differences in their test content that must be considered when trying to compare the results of the two programs. PISA is intended to measure scientific and mathematical literacy, but focuses on measuring the ability of students to apply their knowledge to real-world applications (Kansky, 2). This is in contrast to TIMSS, which is curriculum based and actually measures what students know by grades 4 and 8 (Kansky, 3). Furthermore, one must keep in mind that because PISA tests students at age 15, they are usually in grade 9 or 10 as opposed to 4 and 8 in TIMSS, making the test results not directly comparable (Kansky, 2).

Despite the fact that these three programs may differ in testing procedures and content, their results are often highly correlated. One study found that the correlation between mean country scores in math from PISA and TIMSS is 0.84 (Wu, 3). The correlation between mean country scores in science is even stronger at 0.95 (Wu, 8)[1]. Additionally, the NAEP emphasizes a different subject area every year to match up with the focus subject of the following year's PISA test in order to allow states to compare their results internationally ("International Assessments and NAEP").

United States Achievement Since 2000

The level of improvement in student achievement since the enactment of No Child Left Behind depends on what source you use, but overall, test scores have only made modest improvements at best. Test results from PISA paint a very grim picture of American education, one where student progress started out below the international average (500) and has actually diminished rather than improved. The highest US score in Math occurred in 2000, before NCLB's enactment, at 493, and decreased almost 20 points to 474 in 2006 (OECD). That score improved slightly to 487 in 2009, but was still below its 2000 score. US scores in Science were consistently higher than its Math scores, but still exhibited the same trend: declining scores in 2003 and 2006, followed by higher scores in 2009. The 2009 Science score of 502 was higher

[1] Because Indonesia and Tunisia have abnormally low average scores on both tests, they have a large impact on the correlation. If they are removed from the regression, the correlation for math becomes 0.66 and the correlation for science drops to 0.79.

than in all previous testing years, but still only amounted to an increase of 3 points over nine years (OECD).

Test results from TIMSS are significantly more encouraging. Since 2003, the US has improved in both 4th and 8th grade performance. Only in 8th grade science did US performance diminish, and even then only slightly, going from 527 to 520, and then back up to 525 in 2011 (NCES). The US has also performed well above the international average every year for both subjects and grade levels. Overall, the US has scored better in Science than in Math nearly every year, but had a much faster rate of improvement for math, especially for 4th grade (NCES).

When looking at international testing data, however, it is important to remember how these tests are graded and scored. Rather than being absolute measures of performance, the scores that countries receive are relative to the scores of the other participating countries. In both PISA and TIMSS, test scores are graded and averaged, then scaled such that the international average will be 500. This means that just because a nation's mean score went down, it does necessarily mean that its performance actually decreased. It is possible for a nation's students to improve and still see a declining score if its rate of improvement is slower than that of other nations. Unfortunately, the unstandardized results for the international tests are not reported, which is why we must look at more than just PISA and TIMSS to determine America's absolute improvement.

One way of finding a more objective picture of progress is by looking at results from the NAEP, which tracks changes over time in both short periods (5-10 years) and in long-term assessments (more than 10 years). Using this measure, American educational progress is shown to be real, albeit slight. Between 2003 and 2011, average mathematics achievement increased by 6 points for both 4th graders and 8th graders (Nces.ed.gov)[2]. Science achievement was much slower, increasing by just 3 points between 2000 and 2009 for 4th graders and between 2000 and 2011 for 8th graders (Nces.ed.gov)[3]. This is a similar result to the United States' performance in the TIMSS assessment, which also showed slower improvement for science than for math. Additionally, the gaps between the highest and lowest performing groups narrowed slightly, but significantly. Score gaps between racial groups also decreased. The gaps between white students and black and Hispanic students for math both narrowed by 2 points since 2003 (Nces.ed.gov). However, the gap between students eligible for free lunch and those not eligible has remained the same since 2003 (Nces.ed.gov).

When these results are considered through the lens of No Child Left Behind, however, the modest gains the US has made are clearly not enough. Just 3 years before NCLB demands 100% student proficiency, less than half of students have actually reached that goal. In math, only 39% of 4th graders performed at or above proficiency, along with 34% of 8th graders ("Mathematics 2011," 24, 49). Science performance is even worse, with only 31% of 8th graders testing at or above proficiency ("Science 2011," 13).

Achievement in the United States vs. The World

Although the United States has exhibited some objective improvement in math and science over the past decade, its place among its international peers is less than stellar and has actually declined. In the PISA test, the US has consistently underperformed compared to the

[2] Scores increased from 235 to 241 and 278 to 284 respectively. Both differences are statistically significant ($p<0.05$).

[3] Scores increased from 147 to 150 and 149 to 152 respectively. Both differences are statistically significant ($p<0.05$). Dates are different because the 4th grade science assessment was not performed in 2011.

other OECD member nations, having only performed above the international average once, in science in 2009 ("PISA 2009," 8). Since 2003, the US has never performed in the top 15 nations, and with the exception of 2009, only made it as high as rank number 20 ("PISA 2009," 8). Among the countries that scored consistently higher than the US were the Czech Republic, Iceland, Australia, and Austria, as well the regular top performers such as Finland, South Korea, Japan, and Switzerland. What is perhaps even more strange than the US's decline after 2003 was its even sharper downturn between 2000 and 2003. In terms of rank, the US performed the best in 2000, and in only 3 years, dropped 10 points and 5 positions in math, and 8 points and 6 ranks in science (OECD).

As mentioned previously, the US performs much better on TIMSS than on PISA. The US has scored above average every year and has made significant improvements since 2003, though its science scores have always been higher than its math scores. For both grade levels, the US has consistently performed in the top 15 countries for math, and the top 10 for science (NCES). Among the countries that regularly performed higher than the US include Singapore, Russia, Japan, and China (specifically, Hong Kong and Taiwan). The US consistently has performed higher than countries such as Australia, New Zealand, Sweden, and Norway. In no year has 8th grade performance even come close to that of 4th grade, sometimes being over 30 points lower, as in 2011 Math (Provasnik et al., 10-11). 4th graders have gained 23 points in math and 8 points in science. America's 8th graders, on the other hand, have only gained 5 points in math, and actually lost 2 points in science since 2003. Despite this, in the most recent year (2011), US 8th graders outranked 4th graders in math, and were outranked by them in science (Provasnik et al., iii-iv).

However, the difference in results between PISA and TIMSS may have nothing to do with actual testing procedure, and everything to do with the simple makeup of the participating countries. TIMSS includes far more developing countries than PISA does, but still scales its scores so that the average is 500. This means that the US has somewhat of an innate advantage in this examination simply because it is competing with countries like Serbia, Kazakhstan, and Thailand, most of which tend to be poorer and less developed overall (Greene & McGee, 39).

Other researchers have gone farther than just these international assessments and have actually compared US performance down to the state and district level to other nations in an recent report aptly titled "When the Best Is Mediocre." In this report, Greene and McGee show that in math, 68 percent of US school districts perform below the 50th percentile among all developed countries, and only 820, or 6 percent score above the 67th percentile (38).

Quantitative Analysis: Purpose and Procedure

After determining the performance of the United States on its own and in the international context to be lackluster, the obvious questions that follows is what can be done to improve? However, we currently lack the information to properly answer that question, and must perform a more in-depth analysis. Each nation educates their people in different ways, but they can all be considered complex ecosystems influenced by a wide variety of factors: length of school days, number of teachers, amount of money spent, etc. In order to properly prescribe policy changes to improve American education, we must first understand how exactly these factors influence student performance and what, if anything plays a role in determining educational outcomes. Several of these variables will be tested for significance across more than two-dozen nations, which can be subdivided into several categories. These include school funding amounts and sources, school autonomy, personnel treatment, and student experience.

Each variable has a reason for being included in the analysis, based on public common wisdom and previous scholarship.

There are many factors included detailing funding amounts and sources. First and foremost are those that specify the actual level of education funding between nations. This information is recorded in several ways: in raw dollars (adjusted by PPP), as a percent of total government spending, and as a percent of GDP. Despite many scholars' feelings to the contrary, there is a real, positive correlation between school spending and performance; a meta-analysis of such studies showed an 11-1 ratio of studies showing such a relationship to those that showed no correlation (Robison). Operating under this idea that a student performs better when he has greater resources at his disposal, it's predicted that nations with a higher level of objective and relative funding per student will have better performance.

Two other variables addressing the amount of funding that comes from different sources were included: the percentage of initial (pre-transfer) funding for education that comes from the central government, and the percent that comes from local governments. The reason for these factors being included has to do with the issue of school equity in terms of performance and funding. Because of the unique method of funding used in the US where local schools are funded largely by property taxes and inequities in state aid to schools, underperforming schools and schools in impoverished areas receive less money than excelling schools (Baker & Corcoran, 1-3). This creates a high degree of inequality between the highest and lowest performing US students. Assuming that the federal government is better at appropriating funds more equitably than sub-national governments, the hypothesis for these variables is that nations with a higher percentage of funding that comes from the federal government will have higher average test scores.

Teachers and other school personnel are represented though variables regarding their jobs. Average salaries at the beginning and end of their careers are included for both elementary and lower-secondary schoolteachers. Many believe that if teachers are given higher salaries, they will have more incentive to promote student achievement and more qualified candidates will be attracted to the profession. Previous research has confirmed this idea, showing that higher average teacher compensation is correlated with higher student performance, which is why the same relationship is expected from this analysis (Carnoy, et al., 47).

Several measures of school autonomy were included in the study, such as school autonomy over budget management, course content, and student assessment strategies. These were derived from an OECD survey of school principals that asked them if they felt that they had control over these areas, and then reported the percent that responded affirmatively ("What Makes A School Successful?," 70-71). It should be noted that these numbers are self-reported and may not exactly match external analyses of governance in these countries, but it can be assumed to be fairly accurate for the purposes of this study (Mintrom & Walley, 258-259). Initial hypotheses predict that higher values for these will result in higher test scores. This is consistent with other studies that have shown varying degrees of positive correlations between test scores and measures of school autonomy (Mintrom & Walley, 263).

Aspects of the student experience, such as class sizes and mandatory time in school, are also being included in this analysis. The classroom environment itself has an undisputed effect on a child's ability to learn, and one would think more time spent in that class would correlate to better performance. Because actual class sizes are somewhat difficult to measure accurately, the data that will be used in this study is actually a measure of the average student-to-teacher ratio in each country ("Education 2012," 63). Class time will measured in the total mandatory class time

in the years up to the relevant testing year (such as 4th or 8th grade) ("Education 2012," 61). Though many scholars disagree on the issue of class sizes, there is a solid body of evidence suggesting a negative correlation between class size and test scores, ranging from small to larger effects as classes get closer to 1 (Averett & McLennon, 48-49). Therefore, the same relationship is expected in our analysis. Although there is not much comprehensive scholarship on class time, it is predicted to have a positive relationship with test scores.

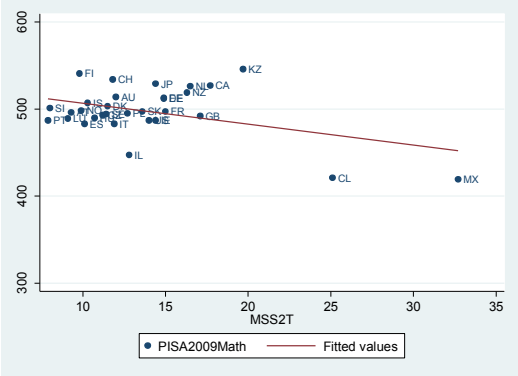
Although it hasn't been discussed at great length previously, child poverty is also included in this study. For our purposes, the child poverty rate is equal to the percent of children that live in households that earn less than half the country's median income. Despite the fact that this is a somewhat exogenous variable and cannot be directly controlled by schools and education policy, it is a very important indicator of the effects of poverty and inequality on education. Previous studies have shown that a country's Gini coefficient is negatively correlated with test scores, and that poor students are more likely to underperform (Carnoy et al., 37). Because of this, it is predicted that nations with higher child poverty rates will have lower relative test scores. This data comes was collected by the OECD ("Child Poverty").

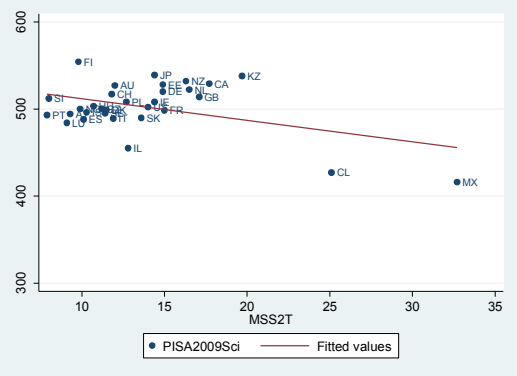
These variables were first individually tested for correlation with results from the most recent PISA and TIMSS results (2009 and 2011, respectively) in both math and science, and then tested in aggregate by OLS regressions to determine statistical significance. Most of the independent variable data are, unless otherwise noted, from 2009 to match up with the 2009 PISA testing date, which is often the most recent year available. Only a cross-section analysis is being done because although there is sufficient data going back to 2003 and earlier, there is not enough variance in the independent variables over that time frame to warrant a time series regression.

Interpretation of Results

The preliminary graphs made from the individual analyses show that most variables do appear to be correlated with academic performance, and usually in direction predicted. As expected, child poverty was consistently and negatively correlated with performance. Per student spending also followed the initial hypothesis, being positively correlated with all test scores with the exception of 4th grade science. Contrary to the initial hypotheses, the amount of compulsory class time to reach 4th and 8th grade appeared to actually have a small, but consistent negative correlation with test scores.

One other anomalous result was in the case of student-teacher ratios. At first glance, there appears to be a negative correlation between the ratio and performance. However, if you remove the two countries that appear to be outliers (Chile and Mexico), then there appears to be no significant correlation whatsoever.





Only a handful of variables showed no effect. Surprisingly, percentages of funding that come from federal and local governments show essentially no correlation at all, contradicting one initial hypothesis. Additionally, relative measures of education spending also showed no correlation. Both spending as a percentage of GDP and as a percentage of total government expenditure showed no effect on any test data and also had a great deal of variability. These variables were excluded from the regression in order to prevent interference with variables that were more likely to actually show significant effects.

The results of the OLS regressions make it clear that the graphs should not be taken at face value. Multiple regressions were performed for each test, each including progressively more of the variables that previously appeared to be correlated with the test results. For PISA, these included: all three school autonomy variables, total student spending, the child poverty rate, teacher's base and maximum salaries, and compulsory school time. For TIMSS, the variables included were: the school autonomy variables, total student spending, the child poverty rate, student-teacher ratio, and teachers' base and maximum salaries. The best results were from the models that excluded teachers' salaries and compulsory school time. As you can see in Table 1, after model 3, the R^2 value decreases, meaning that adding more variables decreases the usefulness of our models.

Most variables included do exhibit their previously discussed correlations, though almost none of them are statistically significant at a reasonable p-value. Although School Assessment Autonomy appears to be significant in the models that only include the Autonomy variables (as well as School Budget Autonomy in the case of Science, albeit a weaker significance), that result is reversed in all other models. This could have been caused by the drop in complete data points by over 20 in the other, more complete models. Furthermore, variables such Teacher Starting Salaries and School Course Content Autonomy showed no significance in any models. Those variables that are significant, however (child poverty and total per student spending), are generally significant across all subjects, tests, and grades.

Table 1.

	PISA Math					PISA Science				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
School Assessment Autonomy	1.09**	0.491	0.449	0.286	0.538	0.913*	0.408	0.37	0.249	0.642
	(2.37)	(1.27)	(1.29)	(0.71)	(1.14)	(2.11)	(1.04)	(1.02)	(.57)	(1.32)
School Course Autonomy	-0.276	0.22	0.025	0.242	-0.009	-0.215	0.294	0.119	0.257	-0.113
	(-.69)	(.68)	(.08)	(0.66)	(-.02)	(-.57)	(.89)	(.38)	(.65)	(-.26)
School Budget Autonomy	0.413	-0.04	-0.234	-0.26	-0.296	0.447*	-0.054	-0.227	-0.25	-0.282
	(1.51)	(-.18)	(-1.09)	(-1.03)	(-.92)	(1.73)	(-.23)	(-1.01)	(-.92)	(-.85)
All Spending per Student	-	0.00909***	0.00641***	0.0032	0.00441	-	0.00793***	0.00554***	0.00331	0.00512
		5.44	(3.63)	(.84)	(.95)		(4.67)	(2.99)	(.81)	(1.07)
Child Poverty Rate	-	-	-2.67***	-2.95**	-1.299	-	-	-2.38**	-2.56**	-0.345
			(-2.86)	(-2.66)	(-.55)			(-2.44)	(-2.14)	(-.14)
Teacher Base Salary	-	-	-	0.000196	0.000531	-	-	-	0.00029	0.00082
				(.16)	(.4)				(.22)	(.59)
Teacher Maximum Salary	-	-	-	0.000366	0.000089	-	-	-	0.00015	-0.00021
				(.65)	(.14)				(.25)	(-.3)
Compulsory School Time	-	-	-	-	-0.00959	-	-	-	-	-0.014
					(-.82)					(-1.17)
R-squared	0.2044	0.5127	0.62	0.5906	0.5376	0.1966	0.4475	0.5415	0.4975	0.502
Adjusted R-squared	0.161	0.4477	0.5545	0.4603	0.3201	0.1527	0.3739	0.4625	0.3376	0.2676
* = p < .1										
** = p < .05										
*** = p < .01										

The strongest factor influencing performance in both math and science is the child poverty rate. That this variable is an indicator of performance is not surprising in and of itself, but what is surprising is the strength of the relationship. A nation's test scores can drop anywhere between 2 and 3 points for each percentage point increase in the poverty rate. Furthermore, it is one of the only statistically significant variables, and with an R^2-value of >0.5, it explains over half of the variation in test scores by itself. In the full model, it is the only variable that remains statistically significant. This indicates that the one of the only factors that is significant across all countries is outside the schools themselves.

One of the only other consistently significant was the objective measure of spending. It held its significance across models in PISA results, as well as most models for TIMSS scores. In various models, for each additionally $1000 spent per student, test scores will increase by between 6 and 10 points. All Spending can account for about 30% of the variation in PISA test scores.

Although results from TIMSS test were included and tested along with PISA results, it does not yield particularly useful results for our purposes, and as such it's best to focus on PISA tests. This is most likely due to a lack of robust and consistent data, which is a issue caused by the particular way the test is administered. First, countries are not required to participate for both grade levels and both subjects, which holes in the data. Additionally, because it includes more underdeveloped and developing countries and does not require OECD members to participate, it is difficult to find accurate data for our independent variables, most of which is provided by the UN and the OECD. In our analysis, as more variables are included, the total number of included countries diminishes to less than 10. While the results from the PISA test were not all that much better, with a total number of data points of between 20 and 25, 10 data points simply are not enough to support valid conclusions.

Further Investigation

If anything can be gleaned from this quantitative analysis, it's that while many factors influence educational outcomes, what works for some countries may not for others. This is because of great variations that exist between educational systems in different countries, and drawing broad conclusions for such international comparisons would of little practical use at best, and irresponsible at worst. But this does not mean, however, that comparing countries on education is impossible. It simply means that either we must look at education systems as a

whole and take into account their differences when making policy prescriptions, or choose a select few countries to analyze and compare them in depth. It is for this reason that we transition from our quantitative analysis into a more qualitative assessment of a select number of nations that will cover a variety of areas. This will allow for a better understanding of not only how other nations approach education, but also a more in depth understanding of how they achieved the level of performance they did.

The following three nations were chosen for further inquiry: South Korea, Canada, and Finland. All of these nations have outperformed the United States for at least a decade and have consistently appeared as some of the top nations in the world for science and math education. They provide a diverse selection of nationalities and geographic locations (Asia, Europe, and North America), and, for reasons that will become clear, a diverse selection in terms of how they approach education.

These select countries will be described and evaluated on five categories related to their structure and policy. Administrative Structure will describe what offices make and implement education policy and at which levels of government they operate. Financing is self-explanatory, describing how much funding is delegated for education, who pays for it and where the money comes from. Teacher Training, Quality, and Compensation will cover the steps through which citizens become teachers, how much they are paid, and how they are held accountable. Student Experience will contain information regarding a variety of things such as how much time students spend in school, their schedule, and class sizes. Finally, School and Student Accountability will describe the procedures used to review student performance and how the teachers and schools are held accountable for it.

While it may seem strange to analyze information that was just previously deemed not significant in the quantitative model, it is important to remember that just because a variable was not significant in the international model, doesn't mean it is insignificant in any individual country. As mentioned before, there are huge differences between education systems in terms of governance, accountability, and resources, and because of this different variables will have different impacts. For example, the OECD calculates for each member country the effects of things like socioeconomic status, ethnic makeup, and disciplinary climate on PISA test scores, and the results vary wildly from country to country ("PISA 2009," 11, 18). This is why all variables are now being examined for each nation.

South Korea

In the entire world, perhaps no country has exhibited faster and more dramatic growth than South Korea. In little more than half a century, it has gone from one of the world's poorest nations to one of the wealthiest. Despite a severe financial crisis in the 1990s, Korea entered the 21st century with even stronger economic growth than before. South Korea now ranks in the top 20 richest nations in the world, with a GDP per capita of over $30,000. But its gains are not only limited to the economy: in those same 50 years, Korea went from having one of the least educated populations to having one of the best education systems in the world. In the 1960s, only about 30% of South Koreans were literate; today, the nation sports a near perfect literacy rate of 97.9% ("Literacy"). Korea has scored exceptionally well on international examinations as well. It has only ranked below the top 3 countries once on PISA (science in 2006), and has consistently performed in first or second place on TIMSS in math and the top 5 in science, always well ahead of the United States (OECD). This is in spite of its child poverty rate of more than 10%, which is just below the international average ("Child Poverty").

Administrative Structure

The South Korean education system operates at all three different levels of government: national, regional, and local. National education policy in South Korea is set by the Ministry of Education (*gyoyugbu*), which is currently headed by Minister Seo Nam-Soo and Vice Minister Na Seung-Il ("Ministry of Education"). The MOE is composed of the Inspector General's office, the Office of Planning and Coordination, the Education Policy Office, and the Office of University and College Affairs ("Ministry of Education"). Each of these offices is made up of two or more bureaus, which themselves consist of 4 or more divisions. There are also several autonomous bureaus in the MOE, such as the Local Education Bureau, the Lifelong and Vocational Education Bureau, and the Educational Information and Statistics Bureau ("Ministry of Education"). The Ministry sets education policy, such as curriculum and educational goals, nationally, but it is mostly carried out at lower levels of government.

At the regional level of government, there are 16 Municipal and Provincial Offices of Education, 9 of which serve each of Korea's provinces, and the other 7 serving the nation's largest metropolitan areas such as Seoul and Busan (Chung, 60). These regional offices are divided into two parts: a School Affairs Bureau, and an Administration Bureau (Chung, 61). Each of these regions also has a board of education, which, along with a superintendent and vice-superintendent, controls the regional office. All board members, as well as the superintendents, have been elected by an electoral college system since 1994 (Chung, 61). The regional offices are responsible for carrying out directives from the MOE, reviewing and approving school finances in their areas, inspections of district offices, as well as managing high schools in their jurisdictions (Chung, 61).

Finally, at the local level, there are 186 District Offices of education. Like the higher regional offices, each District Office is divided into a School Affairs Division and Administrative Division, and is led by an Officer of Education (Chung, 60). These local offices oversee all of the kindergarten, elementary, and middle schools in their respective jurisdictions. They handle budgeting, planning, and regulating these schools "within the standards set by higher level authorities" (Chung, 62).

Financing

South Korea devotes a great deal of funding to education. In 2009, just over 15% of public expenditures were for education, but that amount has reached as high as 23% in 1995 (Chung, 65). Despite this, Korea actually spends about $1,000 less per primary school student than the average OECD country, and spends about the same as the OECD average for secondary school students ("Education 2012," 42)[4]. Its primary school spending is similar to that of New Zealand, and its secondary school spending is similar to that of Japan and Canada. Funding for education at all levels comes primarily from the Ministry of Education, which accounts for almost three quarters of total spending ("Education 2012"). This is in contrast to the US, where less that 9% of total funding comes from the federal government ("Education 2012").

Funds used by the Ministry are divided into two different accounts: the general account and the special account. The general account receives money from "property, sales of goods and services, sales of capital assets, and foreign borrowing," and it funds the Ministry's operating costs, as well as grants and subsidies for public institutions at all levels (Chung, 63). The special

[4] OECD averages are $7,719 and $9,312 for primary and secondary school students respectively. Korea spends $6,658 and $9,399 per student respectively.

account receives revenue from a transfer tax on local education, an "education tax," and carryover from the previous year, and spends that money on improving primary and secondary schools, as well as a fund for private education (Chung, 63).

In total, about 72% of education funds come from the central government, but for primary and lower-secondary education, between 80 and 85% of funding, the rest being paid by local governments and parents ("Education 2012," 49; Chung 66). Much of this funding comes from South Korea's "education tax," which is a much different method than is used in the US and other nations (Chung, 64).

Private financing plays a large role in South Korean education, more so than in almost any other developed nation. Private funding increases at each progressive level of schooling, to the point where almost three quarters of universities are privately funded (Chung, 66). This is because education is free at the lowest levels, but gets increasingly more expensive and competitive past middle school. Private sources account for almost 25% of financing for primary and secondary education, but almost 75% for tertiary education (Chung, 66). Private schools in Korea generally receive large subsidies from the government, yet parents still pay for private tutors, preparation for college exams, and cram schools. It's estimated that Korean parents spend on average $1,000 a month per child on education, totaling $19 billion in 2009 (Strother, 2).

Teacher Training, Quality, and Compensation

Teachers are well respected in South Korean society, and as such, it is a very attractive occupation. Teachers are also paid very well in Korea, especially in comparison to other nations and even other professions in the country. Although a teacher's initial salary is only just about $31,000, the maximum salary for primary and secondary teachers is among the highest in the world, the first being those in Luxembourg ("Education 2012," 65). After 15 years, a Korean teacher can expect to make almost $55,000 a year, and will eventually make just over $87,000 a year (Ncee.org). At the later stages in their careers, Korean teachers make between 2 and 3.5 times that countries GDP per capita, whereas those in the US make only 1 to 1.25 times GDP per capita (Ncee.org).

South Korea has somewhat stricter standards for teachers than in many other countries, primarily in its strict regulation that all teachers, even part-time ones, must hold a teaching certificate that takes several years to complete (Ncee.org). South Korea offers a number of different education paths for teachers depending on the grade level they choose to teach. Primary school teachers are almost all educated at one of the country's 11 national teachers colleges ("Korea," 19). In order to attend, they must have graduated from high school and have performed well on the national "College Scholastic Ability Test." Graduates of these schools receive 4-year bachelor's degrees, and then receive a full teaching certificate after 3 years of experience (Ncee.org).

Unlike for elementary school teachers, there are multiple paths to becoming a secondary school teacher in Korea. They can be educated at teachers colleges, education departments in general colleges, or graduate colleges of education ("Korea," 19). Although the quality of these different programs can vary greatly, all prospective secondary school teachers are required to complete a minimum of 140 credit hours in a general curriculum provided by the Ministry of Education ("Korea," 19). All public school teachers must take and pass a test administered by the regional Offices of Education in order to be hired.

Student Experience

Schooling in South Korea begins at age 6 and is compulsory until age 15 ("Korea," 14). Although early childhood education is optional and largely private, public elementary and middle schools are free for all students, though some urban middle schools do charge small fees for attendance ("Korea," 15). After the age of 15, attending high school is not mandatory, but almost all Korean students (97%) choose to stay in school, and have the choice of continuing in an academic school or attending an alternative such as a vocational or a specialty school ("Korea," 15). Most high schools, even public ones, charge tuition fees.

Unlike in the United States, Korean schools operate year round. The typical school year is divided into two semesters, the first starting in March and ending in July, and the other lasting from the end of August until February. Schools often schedule short, two-week vacations in the middle of these semesters. Nevertheless, South Korean students spend less time in class than other nations. Between the ages of 7 and 14, students in Korea have slightly less than 6,000 hours of compulsory schooling, compared to almost 7,000 hours in the average OECD nation ("Education 2012," 61).

Korea has some of the largest average class sizes in the world, with 28.6 students per class in public primary schools, and 35.3 students per class in public lower-secondary schools ("Education 2012," 63). Class sizes in private schools are only slightly less, with 30.5 and 34.1 respectively ("Education 2012," 63).

As mentioned before, South Korea is unique in that many students receive education through private, not public, schools. Apart from tutors or special 'cram schools,' the number of schools that are private increases at higher grades than lower ones. Whereas nearly all primary schools are public (98.4%), almost a quarter of middle schools are private, along with over half of high schools (Chung, 66)[5].

Student and School Accountability

Like most other East Asian countries, South Korea has for many years been seen as a nation obsessed with tests. While this view is still true in some respects, it is mostly applicable to upper secondary and tertiary education. The most important exam taken by Korean students is the "College Scholastic Ability Test," which is used for admissions purposes by all Korean universities, and for which many students begin preparing as early as elementary school ().

Primary and secondary schools are reviewed periodically by external groups that are established by the regional offices of education. Using a set of standards laid out by the Ministry of Education, they inspect schools and evaluate their teaching methods, curriculum, and student needs (Ncee.org). Exceptional schools are rewarded with bonuses from the Ministry of Education, but underperforming schools are not punished; rather, they are given extra instruction from the government on how to improve (Ncee.org). The national government does, however, administer nationwide tests each year for 4th, 8th, and 12th graders, but these are only used as an informative, data-gathering measure and are not used for accountability purposes (Ncee.og).

Teacher performance is evaluated at the school level by individual principals, but are not directly rewarded or punished by them. Though salary rewards for teachers are fairly small, high performing teachers can be awarded the distinction of "Master Teacher" for a single year by the regional Offices of Education, which comes with a number of privileges such as research opportunities, government subsidies, and less required teaching time ("Master Teachers"). In exchange, they are expected to share their expertise and help train other teachers by giving

[5] 21.8% of middle schools and 53.8% of high schools.

lectures, assisting new teachers and creating new student assessment techniques ("Master Teachers").

Canada

Like many other nations, Canada transitioned from a mostly rural society in the mid-20th century to a busy, industrial one by the end of the century, becoming the 10th largest economy in the world. Canada has also made significant strides in improving its education system, as shown by its consistent performance in the top 10 countries the PISA test and its 99% adult literacy rate ("Literacy"). It has also been the nation with the most consistent performance in PISA, placing 5th every year except twice in Science. Canada has been able to achieve the highest educational performance and the greatest amount of educational equity in all of North America, despite having a child poverty rate of 15%, well above the international average (Vargari, 243, "Child Poverty"). To some, this has been a surprising result given that Canada has one of the most decentralized education systems in the world. It is difficult to give an overview of the entire Canadian education system because the individual provinces can differ significantly, but many aspects of it are uniform across the nation.

Administrative Structure

Unlike most other industrialized countries, Canada's federal government has no department of education and plays almost no role in providing non-tertiary education. Canada's constitution addresses education directly, stating, "in and for each Province the Legislature may exclusively make Laws in relation to Education" (Vergari, 232). This means that the creation and implementation of education policy is solely the responsibility of each individual province. Each of the ten provinces and three territories has its own department or ministry of education with their own duly elected ministers ("Education in Canada"). Although education policy can differ between provinces, the Ministers of Education formed the Council of Ministers of Education Canada (CMEC) in 1967 as a forum in which to "discuss matters of mutual interest, undertake educational initiatives cooperatively, and represent the interests of the provinces and territories with national educational organizations, the federal government, foreign governments, and international organizations" (Vergari, 233). The Federal government is, however, responsible for the education of those that are not under the jurisdiction of any particular province, such as members of the military and their families, federal prisoners, and Aboriginal people living on reserves (Vergari, 233).

Each Ministry of Education is responsible for developing the overarching education policy for the entire province. They develop curriculum and accountability standards, as well appropriate funding to schools and oversee the teacher training and certification process. Education policy in each province is usually implemented at the local level by publically elected school boards ("Education in Canada"). The power of these boards is at the discretion of the provincial government, but they are usually responsible for the management of personnel and budgets for schools in their jurisdictions, as well as the implementation of the curriculum and overseeing the institution of new programs and policies (Ncee.org, "Canada").

Financing

Similar to the division of power in Canada, the Provincial governments provide the majority of public funding for education. In 2008, provincial governments provided 74% of total funds, local governments provided 25%, and 1% came from the federal government (Vergari,

233). However, recently some provinces have moved to a system where the contribution from local governments is nearly 0 (Ncee.org, "Canada"). Provincial governments provide schools with funding based on a formula recalculated annually that takes into account the number of students they serve and their level of need (Ncee.org, "Canada"). For the most part, local schools boards can allocate the provincial funding as they see fit. This system of funding creates a high level of equity between schools in each province, and lessens the impact socioeconomic status has on school performance. For the 2007/2008 school year, total education spending nation wide reached over $51 billion, though the amount varies greatly between provinces, and generally is correlated with the size of the student body (Brockington, 15). For example, Ontario has the largest student population by far with over 2 million primary and secondary school students, and also spends the most, over $21 billion (Brockington, 39, 21). This is in contrast to the lowest spending territory, the Yukon, which spends only about $100 million a year and has only around 5,000 students (Brockington, 39, 21).

Per student spending in Canada in greater than the OECD average, with a provincial average of $10,678 (Canadian dollars) between 2007-2008 (Brockington, 17). Most provinces have similar levels of spending, 8 of which spend between $9,500 and $11,100 per student (Brockington, 40). However, there are several outliers that greatly affect the national average. Prince Edward Island has the lowest spending with $9,260 per student annually, but the three highest spenders pull the average significantly upwards (Brockington, 40). The Nunavut territory spends $15,610 per student, the Northwest Territories spend $18,256, but the highest spender by far is the Yukon, which spends $20,539 per student (Brockington, 40). With the exception of these three territories, per student spending in Canada is significantly lower than in the US, which spends almost $14,000 per student ("Education 2012," 43). This is not as surprising as it may seem at first glance, because these territories also have the smallest student populations in the nation, each with fewer than 10,000 students in public elementary and secondary schools, and with lower than average student-teacher ratios, have more resources to devote to each student (Brockington, 22). National per-student spending has increased every year since 2001 at a rate much higher than the annual rate of inflation (Brockington, 15).

Teacher Training, Quality, and Compensation

Canadian standards for teachers in terms of their training are fairly rigorous. Teachers generally need either a bachelor's degree in education or a bachelor's degree plus an additional year of teacher training in order to begin teaching, although some provinces require further training in order to teach at the secondary level (Ncee.org, "Canada"). Although provincial governments can set differing standards for teacher education, there are only about 50 education programs in the country, making it easy to govern their quality (Ncee.org, "Canada"). Most of the country also requires teachers undergo an examination or certification process before beginning full time teaching work.

Teachers in Canada are generally paid very well, even in comparison to other professions in the country, making it a very attractive position for Canadian students, allowing schools to be able to choose from among the most qualified candidates. Teachers in Canada earn on average 1.2 times the national GDP per capita, and are paid well above the OECD average for teachers (Ncee.org, "Canada"). Depending on the province, a teacher can earn anywhere from $50,000 to $90,000 a year by the end of his career, compared to the international average of around $40,000 (). Although Canadian starting salaries are slightly lower than those in the US, maximum salaries are on average slightly higher ("Education 2012," 65). Prince Edward Island has the lowest

average salary, and to little surprise, the three smallest territories, Nunavut, the Yukon, and the Northwest Territories, have the highest (Brockington, 19). Teachers in Canada also reach the top of their career ladder faster than those in other countries, usually only needing between 12 and 15 years of experience to reach the maximum salary (Ncee.org, "Canada").

Student Experience

Education in Canada is free for all students from the ages of 6 to 18, and in most provinces is compulsory until age 16 ("Education in Canada"). In Ontario, New Brunswick, and Manitoba, however, students must remain in school until 18 ("Overveiw"). Parents have the option of placing their children in a preschool or kindergarten program, but schooling is non-compulsory until age 6. A typical non-tertiary school year is 190 days long (180 in Quebec) ("Overview"). Partially due to more compulsory education, Canadian students spend around 920 hours in school each year in primary and secondary education ("Education 2012," 61). Schools generally operate on a semester system, the first starting in September and the second ending the last week of June.

Canada has one of the lowest average class sizes in the world, with a nationwide student-educator ratio of 14.4 (Brockington, 34)[6]. Class sizes are relatively equitable between provinces, with about half having a ratio of just about 14, the highest being 16.5 in British Columbia, and the lowest being 10.6 in the Yukon (Brockington, 34). Average nationwide class sizes have been decreasing every year since 2002 (Brockington, 34). This is much lower than the average in the US of 20 ("Education 2012," 63).

There is no national curriculum in Canada, and every province is free to develop their curriculum to emphasize what they feel is most important (Vargari, 239). However, since the creation of the CMEC, curriculums are often more similar than they are different as provinces have collaborated to find what is the most effective (Vargari 242). Starting in secondary school, students can choose to take classes with a more academic focus if they plan on continuing their education into college, or if they plan on going straight into work, they can take more focused, vocational classes ("Education in Canada").

Students have the right to attend non-public schools, such as religiously affiliated private or charter schools, but these schools are still partially government funded and serve less than 10% of Canadian students ("Education in Canada"). They are also held to the same standards and curriculum requirements as regular public schools, except for independent schools, which have more leeway and operate within a more general set of guidelines (Ncee.org, "Canada").

Student and School Accountability

Canadian provinces are responsible for handling their own testing and accountability programs, as no such policy is implemented federally. Unlike in the US under NCLB, there is a fairly weak accountability regime in Canada, and in recent years many provinces have eliminated their strict teacher oversight programs. Instead, teachers are held accountable by their peers and local officials, and there are few rewards given to exceptional teachers and punishments for underperformers (Vergari, 240). In following with this philosophy, schools that falling behind are encouraged to improve their current staff rather than replace them (Ncee.org, "Canada"). Students however are regularly subject to testing in core subjects at certain grade levels that differ between provinces.

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[6] In public elementary and secondary schools for the 2007-2008 school year.

Although there is no federal testing program, the CMEC does administer an exam nationwide called the Pan-Canadian Assessment Program every three years, though it is solely for the purpose of measuring progress and not for accountability (Vargari, 237). The PCAP is taken by a random sample of 8th grade students from each province, and emphasizes a different subject (reading, math, or science) each year it's given (Vargari, 241). This is so that it corresponds with the PISA test and that its results can more easily be compared to other nations. According to the most recent PCAP examination done in 2010, students in Alberta performed at the average level in math, whereas students in Ontario and Quebec scored significantly higher than the average ("PCAP 2010," 24). The other eight provinces scored significantly lower than average, with Prince Edward Island at the bottom with an average score of 460 ("PCAP 2010," 24). In science, Alberta and Ontario scored above average, British Colombia and Prince Edward Island scored at the average level, and the other 7 provinces fell below average, the lowest scoring being the Yukon with a score of 478 ("PCAP 2010," 41).

Finland

One of the most surprising results of the international education surveys was the consistently high-ranking performance of Finland. Although it had been a small, mostly agrarian society just 50 years earlier, Finland nonetheless scored among the top 5 nations on the PISA test in all subjects and in all testing years, and boasts a 100% adult literacy rate ("Literacy"). Though it has not been a regular participant in the TIMSS exam, when it did participate in 2011, it placed 8th in math and in the top 5 in science ("TIMSS 2011," 11, 43). The country is known for its education policy, which focuses on "quality, efficiency, equity and internationalization," and for enshrining the right to "basic education free of charge" in its constitution (Minedu.fi; "Constitution of Finland"). This has resulted in Finland having a between-school score variance of about 8% when the OECD average is around 33%, making it in some ways the most equitable school system in the world ("What Makes A School Successful," 57).

Administrative Structure

Like many other developed nations, education in Finland is structured with three tiers: the national government, local governments, and individual schools. Finland is known for having a highly decentralized and autonomous school system, passing many responsibilities onto schools themselves with relatively little direction from the central government. Responsibilities at the national level are divided between two agencies, the Ministry of Education and Culture and the Finnish National Board of Education ("Finnish Education System," 16). The Ministry is responsible for formulating national education policy, and the Board of Education is generally in charge of its implementation ("Finnish Education System," 16). The Board is also responsible for building a national core curriculum, developing standards for student assessment, as well as information services and developmental work ("Finnish Education System," 16).

Local governments are all expected to provide primary and lower-secondary education, whereas high schools are managed by certain regional governments and associations that are chosen by the Ministry of Education and Culture. Regional governments play very little role in managing their schools however. Apart from appointing principals to schools for six to seven year terms, most management decisions are made by the schools' teachers and staff. Principals are primarily responsible for managing the budget and staff, but usually do so alongside the teachers themselves. Although there is a national curriculum, teachers are given the freedom to

implement it however they choose, and can design their own lesson plans and choose their own textbooks (Mintrom & Walley, 262).

Financing

Unlike most other nations, the education system in Finland is completely government funded, which has contributed to its goal of student equity and resulted in a system with high school equity and where socioeconomic status has very little effect on student achievement ("What Makes A School Successful," 57). This is in contrast to the US, which has highly inequitable funding and where socioeconomic status is a large factor in academic performance ("What Makes A School Successful," 57). Depending on the measurements used, Finland funds education equal to or greater than in its peer countries. In 2009, Finland spend 12.4% of its total public expenditure on education, which equals about 6.1% of their GDP for the same year ("Education 2012," 49). On average, Finland spends slightly more than the OECD average per student, however this figure is slightly misleading ("Education 2012," 43). Finland spends $500 less than the OECD average for each primary school student, but $2,100 more than average for each lower-secondary student (Ncee.org, "Finland").

Education spending is fairly evenly divided between the different levels of government, with the national government provided about 46% of the total funding, with the rest coming from local governments ("Improving School Leadership," 12). Finland's central government spends a greater percent than the US or Canadian federal governments do, but less than in South Korea.

Teacher Training, Quality, and Compensation

High quality teachers are often seen by the Finnish people as the main driver of their excellent education system, and command a high amount of public respect, similar to those in South Korea ("Improving School Leadership"; Mintrom & Walley, 263). However, it is not high salaries that attract to many Finns to the teaching profession, as teachers there get paid competitive, but around average wages. They make typically almost $3000 more than the OECD average at both ends of the pay scale (Mintrom & Walley, 263). However, their salaries are less than the average salary for other professionals in Finland, and are slightly lower than GDP per capita (Ncee.org, "Finland"). Instead, many Finns are attracted to teaching because of the level of autonomy and trust bestowed upon teachers. Teachers are given a great deal of freedom to determine their own lesson plans and assessment policies, and are intimately involved with the management and decision-making process of their respective schools (Mintrom & Walley, 262; Ncee.org, "Finland").

Teacher training in Finland is both in high demand and notoriously selective, which allows universities to choose from the best possible candidates. Although Finland used to have specific teachers' colleges for them to attend, since the 1970s teaching programs have been housed at regular universities, although at present only 11 colleges offer them (Ncee.org, "Finland"). Those applying to teachers programs are judged on their performance in secondary school and their score on the Matriculation Exam that all rising university students must take. They are then interviewed and must show potential in a preliminary teaching environment (Sahlberg, 2). Because of the difficult application process, only 10% of those applying are admitted to Finland's teacher programs (Sahlberg, 2). All teachers in Finland are required to have a Master's degree, but the paths that teachers take depends on what level they will be teaching. Primary school teachers need only to major in education and minor in two subjects taught in a primary school curriculum ("Finnish Education System," 23). Secondary school

teachers, however, must major in the subject that they will teach, and complete another year of schooling that is focused on research in their chosen subject ("Finnish Education System," 23). At that point they earn their Master's degree and begin teaching.

Student Experience

Class sizes in Finland are kept relatively small at around 20 students on average in primary and lower secondary schools, just below the average for OECD countries and close to that in the US ("Education 2012," 63). Additionally, almost half of Finland's primary and lower secondary schools have fewer than 100 students ("Improving School Leadership," 10). Interestingly, students in Finland spend the least amount of time in school than almost any other nation in the world. In terms of total compulsory class time between the ages of 7 and 14, only Estonian students spend less time in school than Finland, which averages out to about just under 700 hours a year ("Education 2012," 61). However, their school year is similar to that of other nations including the US, because students spend on average 190 a year in school and have a 60-day summer vacation ("Improving School Leadership," 9).

Compared to other nations, students in Finland do not start formal schooling until fairly late, at the age of seven. Until they reach that age, they can be placed in a preschool program, which is provided by the government completely free (Pellisier). Formal education is divided into just two portions instead of three: comprehensive school and secondary. Education is compulsory for students until age 16, but over 90% of students continue to complete upper-secondary education ("Finnish Education System," 15). After completing 10 years of comprehensive school, students have a choice whether to spend the next 3 years continuing their academic training or studying at a vocational school or apprenticeship ("Finnish Education System," 14). Those who attend an academic secondary school are required to take the National Matriculation Exam in order to graduate and to continue into tertiary education ("Finnish Education System," 14).

Private schools are extremely rare in Finland, and instead of being primarily for wealthier students as they are in the US, the majority of those that exist are religious institutions. These schools are very similar to public schools because they must follow the same core curriculum and assessment guidelines used by all other schools in Finland (Ncee.org, "Finland"). Interestingly, these private schools perform significantly better than public schools even after adjusting for the socioeconomic status of the students (Mintrom & Walley, 261).

Student and School Accountability

Finnish students face few externally administered exams in comparison to many other countries. Instead, schools and local governments are encouraged to self-assess their own progress and achievement ("Improving School Leadership," 19). The government is also considering further devolution of this responsibility by moving to a system of student self-assessment (Ncee.org, "Finland"). The Ministry of Education and Culture works in tandem with the Education Evaluation Council, which performs system level evaluations of national policies (Ncee.org, "Finland").

That is not to say that Finland has no examinations whatsoever, just that most of them are more tailored to their school. The national Board of Education does administer annual examinations of students in Grades 6 and 9, alternating yearly between math and Finnish language (Minedu.fi). Like similar tests in Canada and South Korea, these tests are only meant to determine which students need more help and what can be done better in the future, and not for

strict school accountability like the NCLB mandated tests in the US. Furthermore, all students who do not attend a vocational school are required to take the National Matriculation Exam in order to graduate from high school. This test measures students' performance in their mother tongue, as well as three other subjects of their choosing, including math, science, or a foreign language ("Improving School Leadership," 16). The results of this test also impact students' placement in higher education.

Lessons Learned and Recommendations

While it may seem that these school systems are too different to compare, several important lessons can be gleaned from the above information in context with the American education system. The first is that more resources are not necessarily going to improve performance, but using the resources you have more wisely. As previously seen, all of these nations spend much less time in class and less money per student than the United States, yet achieve much higher performance. They achieve these results partially by giving teachers more freedom in lesson planning and enough time in order to best utilize the time they do spend in the classroom.

Along these lines, one recommendation for the United States is to adjust the school calendar to eliminate the 3-month long summer vacation and use a more standard, year-round schedule. The current 9-month school year used in the US was originally designed to accommodate the lifestyles of students living in agricultural communities, but this consideration became outdated many years ago. Most other nations in the world operate on 11 or 12 month calendars, and while they may spend less time in school in total, it is more spread out and consistent throughout the year. The reasoning for this recommendation is to eliminate the negative effects of what education professionals call "summer learning loss." Studies have shown that students can lose up to a full month, or one tenth of a standard deviation, of performance in mathematics over the summer, putting them at an inherent disadvantage when they restart school in the fall (Cooper et al., 259).

A greater focus in the United States should also be placed on educational equity. The phrase "a rising tide lifts all boats" might sound hackneyed to some, but it certainly appears to ring true with the three example nations, which all have lower between-school score variance than the US, as well as much higher average test scores. They also have lower rates of score variance caused by socioeconomic status than the US. As mentioned earlier, the reason for this is that most education funding in the US comes from local and state governments, which receive money specifically for that purpose from property taxes, instead of the national government, which contributes very little to education. This puts poorer areas at an inherent disadvantage and exacerbates poverty's negative effects on student outcomes. School funding in the United States should be divorced from the socioeconomic status of their surroundings, and the national government should make it so that instead of punishing underperforming schools, which are usually underfunded to begin with, and instead give them the additional resources they need to improve. This would address both the issue of inequality and bring the US more in line with the accountability regimes in place in our example nations.

Good treatment of teachers is also clearly an important factor in student performance as well. Although teacher salaries in the US are relatively comparable to those in other nations, the US is not able to choose from the best quality candidates like other countries are. There are several reasons for this, but they mostly relate to the idea that teaching is not as attractive a profession as it is in other countries. Teacher salaries are two-thirds of the average college

graduate's salary, which coupled with high cost of achieving tertiary education, is a significant barrier for those trying to enter the field. These issues can be fixed by increasing teachers' wages and reducing the cost of higher education.

I would also suggest establishing a more comprehensive national curriculum than is currently in use in the US. The Common Core Initiative is a valiant start towards this goal, however it still has not achieved full adoption from the states (Vargari, 243). This should not be mistaken for an attempt to make all schools teach the same material, however, because as we have seen, schools and teachers must have a certain level of autonomy and choice regarding their course content. Instead, this should be seen as an attempt to combat inequity and ensure students are learning what they are supposed to. An overall curriculum should be similar to the national curricula in our example nations: a set of guidelines detailing what students should be learning, but not instructions for how they should be taught.

Conclusion

The economic collapse of 2009 left the United States eager to find ways to re-inflate its economic performance, and better education seemed to be a way to fulfill the changing needs of the increasingly technology-focused economy. In 2010, President Obama warned the nation that, "countries that out-educate us today will out-compete us tomorrow" (Vergari, 236). This has prompted a surge in support for forward-thinking education policies, especially in regards to STEM subjects. However, as has been seen, the outcome is lacking. The US continually falls below other nations in education performance, routinely is below average, and has not made any significant improvements in a decade. No Child Left Behind is clearly not the kind of policy that will turn the American education system around, and we should look to other, more successful nations for inspiration. From our analyses, several issues need to be addressed in order for education to improve. First are the inequalities in the way education is provided, in terms of differing levels of funding for different schools and their mismatched curricula. Also is the need to improve teacher quality, which can be achieved by raising the social status of the teachers, offering higher salaries and more autonomy, and lowering the currently high barrier to entry in the teaching profession. Finally, our ideas of accountability must be changed. Underperforming students, teachers, and schools should not be scorned, punished, or left behind, but should receive extra help and attention so that they may actually improve. It is ill advised to think that simply funneling more resources into the system will improve the outcome, because as we have seen other countries accomplish much more with much less. Rather, it is about shifting how we use those resources that will make the most difference to our most treasured citizens: our children.

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