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Educational Quality and Egalitarian Educational Structures: A Multi-nation Multi-variate Analysis

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The degree of equality in the delivery of education is an important dimension of variation. Some nations believe that the provision of a highly stratified system enhances quality, at least for the minority who are able to gain entry to the elite academic stream. In contrast, other nations prefer a more egalitarian approach to education where all students attend a common school devoid of ability streams until well into their secondary level studies (Levin, 1978); the egalitarian approach is believed to be just and fair. But does it enhance quality?

While there are a number of studies that explore the academic consequences of tracking and/or streaming within particular national systems, there are relatively few studies that explore this question across several national systems. The recent OECD supported PISA studies (2010 a and b) enable a cross-national analysis; but the official reports from OECD primarily provide bivariate analyses of these relations whereas a multivariate approach taking into account several system level variables is preferred.

In this paper we define egalitarian education, examine its historical origins, specify its contemporary correlates, and drawing on multinational data seek to determine if the single nation findings are replicated in a wider group of countries. Additionally we will focus on the position of Japan and the sub-group of rapidly developing Asian economies relative to other countries.

Keywords: quality of education; equality of outcomes; tracking; streaming; PISA; autonomy

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Introduction

In contemporary societies education is generally regarded as essential for national prosperity and progress (Hanushek and Woessmann, 2008). It is believed that quality education enhances economic competitiveness, political vitality, and cultural creativity (Devroye and Freeman, 2001). Thus nations strive for high quality education. But what are the systemic features of education that enhance quality?

Archer (1979) in her classic study found that the approaches nations pursue tend to be more a reflection of tradition than of rational choice—for example some nations prefer more centralized systems while others prefer de-centralization down to the district and even to the school level.

The degree of equality in the delivery of education is another important dimension of variation. Some nations believe that the provision of a highly stratified system enhances quality, at least for the minority who are able to gain entry to the elite academic stream. (Leschinsky, A. and K. U. Mayer. 1999). In contrast, other nations prefer a more egalitarian approach to education where all students attend a common school devoid of ability streams until well into their secondary level studies (Levin, 1978); the egalitarian approach is believed to be just and fair. But does it enhance quality? (Bunar, 2001)

There are a number of single nation studies that explore the relation of egalitarian education and quality (Entwisle et al, 1997). Oakes (2005) has argued that the academic streaming that is found in many US school districts erodes quality. Gamoran (1992) considered the impact of tracking. OECD (2010d) has highlighted Poland's commitment to equality and the correspondent improvement in student performance. Cummings (1980, 1982) argued that Japan after WWII adopted the egalitarian structural direction, and that it had positive "consequences" for the quality of Japan's educational outcomes. Equality was portrayed as enhancing rather than eroding quality. Moreover, the post World War II increase in educational quality and equality was portrayed as fostering greater equality in the economic, social, and political relations of Japan's adult society. Others have sharply contested these claims (Okano, 1999).

While there are many studies that explore the academic consequences of tracking and/or streaming within particular national systems, there are relatively few studies that explore this question across several national systems (Bain, 2012). The recent OECD supported PISA studies (2010) enable a cross-national analysis; but the official reports from OECD primarily provide bivariate analyses of these relations whereas a multivariate approach taking into account several system level variables is preferred.

In this paper we define egalitarian education, examine its historical origins, specify its contemporary correlates, and drawing on multinational data seek to determine if the single nation findings are replicated in a wider group of countries. Additionally we will focus on the position of Japan and the sub-group of rapidly developing Asian economies relative to other countries.

Methods

This study primarily involves a re-analysis of some of the information reported by OECD for the PISA 2009 Reading study. PISA 2009 is one out of several related youth performance

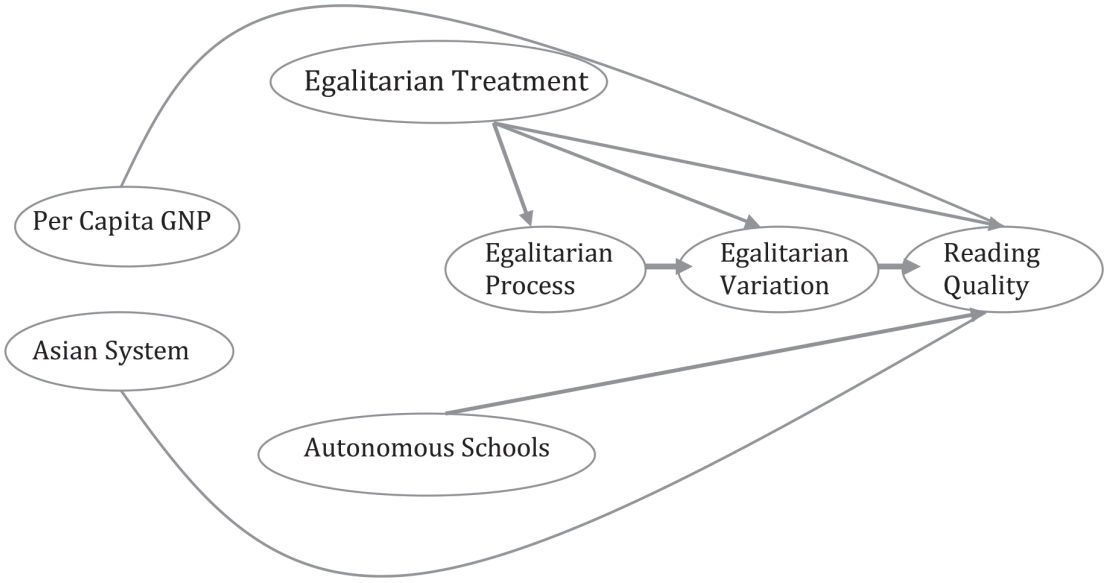

Figure 1 The role of egalitarian treatment in accounting for national level of reading achievement

studies conducted by OECD. There is considerable consistency in the differential performance of national systems across these various surveys so drawing on one (e.g. reading 2009 instead of math or science 2009) is reasonable.

PISA 2009 covered 65 countries (34 OECD countries and 31 partner countries), including Japan. In addition to the information on reading performance, PISA 2009 reported on a wide variety of other indicators drawn from questions addressed to students, school principals, and national experts.

PISA specifies three levels of analysis—the individual level, the school level, and the system level. Some analyses are at all three levels whereas others are only at the individual or school or system level. The analysis of this study focuses on the system level.

The Analytic Model

Figure 1 below presents a diagram of the Model we are proposing for this study. The National Scores on Reading 2009 (our measure of quality) are proposed as the dependent variable. The variables are presented in the form of a path analytic diagram. Egalitarian Variation of Reading Scores is proposed as the Immediate Predictor of Quality, supplemented by Egalitarian Treatment and School Autonomy. Egalitarian Process and Egalitarian Treatment are proposed as predictor of Egalitarian Variation. Egalitarian Process enhances Egalitarian Treatment. School Autonomy is not expected to have a relation with any of the egalitarian variables but is presumed to enhance Quality. Per Capita GNP and Asia are the source variables. Solid arrows indicate the expectation of a positive relation and negative arrows indicate the expectation of a negative relation.

Handling Missing Data

The OECD Reading 2009 survey collected data from 65 "countries".[1] For a comparative study of this kind, that is an impressive number. But for multivariate statistical analysis, it is small. Statistical coefficients can be significantly influenced by the inclusion/exclusion of a single case.

For the measures discussed below of the concepts in Figure 1, there were only a few missing values. While one strategy would have been to drop all countries that had missing values, we chose to limit our selection of variables to those with relatively few missing values, and in the instances where there were missing values we introduced estimates for the small number of missing values. For example, we lacked values for France on four indicators; recognizing the similarity in the Belgian and French systems, we assigned the values for Belgian to the missing cells of the French system. The Swedish value was assigned to the missing cell of Norway. And so on. Altogether we made 11 estimates.

Measuring The Variables

Quality Measurement. The main quality measurement is the average country scores on the 2009 Reading survey. The scores range from 556 for Shanghai-China to 271 for Panama. This quality measure will be the dependent variable for this study. Following OECD, the average country score can also be considered an indicator of equality in the sense that a high average score implies that a high proportion of students in the country are capable readers. Appendix A provides further details on the several measures used in this study; Appendix B presents the scores by country for the included variables, and Appendix C presents the inter-correlations.

Measuring (Equality of) Variation in Reading 2009. An important concern of educators is to achieve a common learning outcome for all students. To the extent the common learning outcome is achieved, the variation in the reading scores of all of the children in a particular national population will be modest. The standard deviation in reading scores is a familiar measure of variation. However, the standard deviation of particular countries is influenced by the position of these countries relative to others; higher mean scores enable the achievement of higher standard deviations. The coefficient of variation (the mean standard deviation divided by the coefficient of variation) is sometimes used to neutralize the influence of the average score on the degree of variation. Higher scores on the coefficient of variation mean a less equal spread. With this study's focus on equality, we sought a measure that gave a higher value to a more equal outcome; hence for our measure of equality of variation, we subtracted the coefficient of variation for each country from 1. Thus a higher value in our measure means greater equality of variation.

Egalitarian Process Measurement. PISA 2009 looks at several measures of equitable process, primarily related to "overcoming social background" as reported in Appendix A of Volume. We have examined these measures and settled on the slope of the SES gradient to indicate egalitarian process. For each country, the SES gradient is the regression coefficient for the bivariate regression equation of SES on Reading 2009. According to OECD, "Within a single

construct, the socioeconomic gradient summarizes many of the aspects of educational equity that can be analyzed by PISA." (II: 52). However with the OECD measure, the lower the value of the slope, the greater is the equality of process. We wanted a statistic where a higher value implied greater equality. Accordingly we subtracted the published values of the slope from 100. Thus, in this study a higher value implies greater equality of process (less influence of SES).

Measuring Structure (Treatment of Students). PISA 09 looked at four areas of structure or Treatment of Students (Volume IV, p. 27):

- How students are selected to schools and classrooms
- Autonomy of the schools in practices related to selecting courses, selecting texts, deciding course content, and deciding on assessment measures
- Resources per student primarily measured by actual expenditures
- Assessment of schools, teachers, and students

Within each area, there are several measures.

Egalitarian Treatment. Selection refers to the extent students in a system are differentially treated, based primarily on their academic performance. For the "selection" area, we created a composite measure by summing the average percent who repeat, the average percent who are transferred, the percent of schools that employ ability grouping, and 7 times the number of tracks found at the upper secondary level in each system. We then subtracted this average score from 100.[2] The selection area reflects the relative equality in the treatment of students: The higher the score on the relative selectivity of systems, the greater is the equality of treatment.

School Autonomy Measurement. For the autonomy area, following the OECD example, we took the average of four indicators to obtain a composite measure of the relative autonomy of the schools within each system. The four indicators are the percentage of schools in each system that establish their own student assessment policies, the percentage that choose which textbooks are used, the percentage that determine course content, and the percentage that decide which courses are offered (IV: 148). The greater the score on the relative autonomy of systems, the greater is the autonomy of individual schools.

Other Areas of Structure. As reported by OECD, the assessment measures had no relation to our measure of quality so we dropped them. Concerning the resources area, there was a relatively strong relation between average teacher salaries and quality; however, there were many missing values so we dropped that as well.

Per Capita GDP. The educational systems of more economically advanced societies tend to do better on measure of educational quality than do those of less advanced societies. To both recognize this fact and to neutralize its impact on our interpretation of findings, we have included a measure of per capita GDP for the year 2007.

Rapidly Growing Asian Economies. A final topic of interest is the special position of Japan and the other Eastern Asian countries. There is an extensive literature focusing on the exceptional economic performance of Asian economies in recent years (World Bank, 1993); and many

of these studies highlight the role of Asian education in fostering this economic performance (Cummings, 1997). Several of the Eastern Asian countries have somewhat similar educational traditions and structures. Moreover, educators in the Asian region frequently meet to exchange insights on best practices. Whether for these reasons or not, it does turn out that many of the Eastern Asian economies tend to realize relatively high scores on the quality measure for Reading 2009. This may be accounted for by the factors already mentioned above, or there may be an Asian impact up and above the impact of these other factors. To enable an evaluation of this proposition, we created an Asian Economy dummy variable with Japan, Korea, Taiwan, Singapore, and China (Hong Kong, Macao, and Shanghai) receiving a score of 1 and all other countries receiving a score of 0.

OECD's Analysis of PISA 2009

OECD's report of PISA 2009 is reported in 5 volumes. Each volume provides extensive information related to the focal topic including, in some instances, reports on bivariate correlations between indicator of interest and the outcome variable of country average reading scores. In one of the volumes, a correlation matrix of the inter-relations of several variables is presented. But the PISA 2009 report does not get into multivariate analyses.

Multivariate analysis is essential in order to determine whether egalitarian education has an impact on educational quality independent of other factors such as national wealth, socioeconomic background, school autonomy, and performance assessment. ***The unique contribution of this paper is to initiate an exploration of the multivariate analysis of the PISA 2009 data set.***

Limitations of the PISA data set. A limitation of all of the PISA studies is that they only focus on 15 year olds. Thus they do not consider earlier ages/grades or the impact of differential experiences at the earlier grades? Some systems are impressively egalitarian at the primary and lower secondary levels, but they begin serious differentiation at the upper secondary level, which is the time many youth turn 15. Others begin horizontal differentiation at earlier grades. But PISA does not take account of these differences in the educational history of the 15 year old pupils. (In the Japanese case, PISA actually sampled students in the first year of high school that is the beginning of horizontal differentiation in Japan, rather than 15 year olds as such).

The Social Origins of Modern "Egalitarian" Education

To gain a better understanding of how systems might line up in terms of egalitarian education, it is helpful to consider several of the major trends in the birth and evolution of modern education (Cummings, 2003).

Traditional Education. Prior to the modern educational revolution, only a minority of the respective populations around the world attended school. The attendees were primarily from aristocratic or clerical families, and the goal of education was to provide these elite groups with the knowledge and manners appropriate for governance and religious leadership.

Reformation. The early inspiration for modern education was the reformation, particularly as it unfolded in Northern Europe. The reformation asserted that all men and women were Equal before God, and that it was essential to read (the Bible) so as to understand God's way. The prospect of reading was assisted by the technological innovation of moveable type enabling the printing of multiple volumes of books of interest. The earliest enrollment progress was in Scandinavia, followed by the German states and Switzerland. Elsewhere in the world there was little change in the degree of access to modern schooling until the middle of the 19th century.

European economic miracle. Following on the footsteps of the reformation was the liberation of many trade barriers leading to the rapid commercialization of most parts of Western Europe. And stemming from the expanding demand for new products, entrepreneurs began to discover new technologies for the mass production of high demand products such as cotton cloth, copper and iron pots, military hardware, etc. During this period, education became very competitive especially at the secondary level, and not very egalitarian (Amano, 1990). In most systems, tracking was introduced with a small academic track and a more extensive and diversified vocational track.

Nationalism/Imperialism. Concurrent with the European economic miracle was an impressive consolidation of political units in Western Europe—from as many as 500 political entities in the 1700s to no more than 30 by the end of the 19th Century. An important theme in the new education was the cultivation of loyalty to the emerging nation-state, but this emphasis was balanced by a stress on respect for the social position of national elites. Several of the rising states of Western Europe looked to other parts of the world for resources to finance their armies and bureaucracies. Thus empires emerged, especially under Spanish, Portuguese, British, French, German, and Japanese hegemony. These empires largely sought to extract resources from the colonized territories; little effort was made to improve the welfare of the colonial subjects. Thus a great divide emerged with Western Europe forging ahead in educational access while the colonized subjects in the vast third world were educationally neglected. And within the respective systems, different schools were established for different classes. Japan also launched a modern educational system with a strong nationalistic thrust, but it did not stress social class differences in access.

Late Colonialism. However, as the Imperial powers came to rely increasingly on their colonies for vital raw materials, they found it necessary to launch fledgling educational systems to train locals for jobs in the colonial bureaucracies. The educational systems set up in the colonies came to mirror the structures of the respective metropolitan models.

Democracy and Inclusion. North America proved to be a somewhat exceptional colonial setting as many of the original settlers were well educated and the colonial governments decided to include them in colonial governance. Eventually this led to an independence movement and the formation of democratic polities. The early leaders of these polities were committed to "democracy for all"[3], and thus from early on supported the widespread establishment of public schools. An important theme in the rhetoric of these new schools was education for democracy. This American model captured the interest of some European educators, notably in the UK and in Scandinavia. Some outcomes were the concepts of the common school and the comprehensive school. Both have strong egalitarian implications.

Socialism and The Welfare State. The stratified approach to education in much of Western Europe was challenged in the early 20th Century by the egalitarian model promoted by the rising Soviet state. Soviet leaders recognized that the Soviet economy needed an educated labor force if it was to catch up with the West; thus the Soviets pushed forward with universal (common school) education through the lower secondary level and a strong vocationally oriented system beyond that. Some European countries, particularly in Scandinavia, came to imitate many of the features of this socialist model. Education was considered both an individual right and a resource for the state.

Massification of secondary and tertiary education. A prominent educational development has been the massification first of secondary and more recently of tertiary education. An important corollary has been the downward pressure for better academic preparation. The US provided the leadership in this expansion, and in recent years the US has been surpassed by several other systems including Korea and Finland. The comprehensive high school was one innovation of this period, though it took on multiple forms as it was adopted in new settings. The major consequence of this trend has been the reduction of academic selection between schools, though possibly replaced by an increased level of selection within schools.

Globalization. A very recent trend in modern education has been the perception that the educational achievement of nations is a vital element in national economic competitiveness. OECD's interest in educational policy is an obvious example of this trend. OECD research tends to indicate the preference for a more egalitarian approach to primary and secondary education, while at the same time offering special opportunities for gifted children. A related theme in recent policy discourse is the strengthening of the autonomy of individual schools, complemented by the increasing assessment of student performance in each school. The implications of these trends are being played out today.

Egalitarianism and Autonomy in The Emergence of Modern Education

Considering these powerful sociological trends, it can be said that several educational approaches have emerged over the course of the modern era. These approaches differ in terms of the period that they emerged, their structural egalitarianism, their emphasis on school autonomy, and the prevalence of performance assessments. Over time it might be said that egalitarian structures and treatments have become more popular as has the emphasis on school autonomy. At the same time, there are powerful anti-egalitarian tendencies in many systems (e.g., separate but equal education, tracking, streaming, magnet schools for the gifted and talented). Examinations are a long-standing feature of education while on-going performance assessments are a new and somewhat controversial development.

Justifying Our Model for the Comparison of Systems

The equity debate usually distinguishes between equality of results and equality of opportunity or treatment. PISA 2009 provides indicators in both of these areas.

Concerning Equality of Results. The key indicator is the country's average score on the reading test: to the extent the average score is relatively high, it can be said that a sizeable proportion of the youth in that country have achieved an acceptable level of reading competence.

Equality of Variation might be considered a second measure of results. If the scores of children are bunched together and are relatively high, it can be said a system is realizing good success in facilitating the learning of all children.

Concerning Equality of Process. PISA 2009 provides several additional indicators of equality of results (Volume II) including the gender gap, the gap between the native born and immigrant youth, the percent of youth that are "resilient." For this study, we considered two: The slope of the SES gradient and the percentage of variance in student performance explained by student's socio-economic background. Finally we selected the first indicator as it has a more robust relations with the other variables included in the study. The country scores on these indicators are presented in Appendix Table B and the inter-correlations in Appendix C. The inter-correlations are weak but most are in the expected direction.

Concerning equality of treatment or opportunity. PISA 2009 presents four indicators: The percent of students in the system that have ever repeated; the number of tracks at the upper secondary level (range from 1 to 6); the percent of students who are likely to be transferred from one school to another because of low or high achievement behavioral problems, special learning needs, or a parent's request; and the percent of schools that group students by ability in all subjects.

A low value on each of these indicators suggests a more egalitarian treatment. The inter-correlations of the four indicators are modest to strong and all are in the expected direction. Given the strength of these relations, we decided to combine these four indicators in a composite variable that we will label as Egalitarian Treatment. (And for the sake of greater ease in reading results, we subtracted the values for the composite variable from 100 so that a higher score indicates greater equality of treatment). It is notable that the Scandinavian countries tend to have the most egalitarian treatments followed by the East Asian countries of Japan and Korea. Several East European countries also have high scores. In general, the OECD countries have higher scores than the Partner countries.

Other Important Variables. Next, we considered the relative autonomy of schools. PISA 2009 highlighted four indicators of autonomy: The percent of principals in each national system that asserted that their schools establish their own student assessment policies, the percentage that choose which textbooks are used, the percentage that determine course content, and the percentage that decide which courses are offered. OECD computed the average of these scores to create a composite School Autonomy variable, and we will follow that procedure. Again the country scores are presented in Appendix B.

The inter-correlations of School Autonomy with the other variables in the analysis are again presented in Appendix C (IV: 53). School Autonomy has a strong positive relation with Quality, a weak positive relation with the Equal Process variables, and a modest positive relation with Equal Treatment.

PISA 2009 reviews many other variables, most notably the national and school level assess-

Table 1 Explaining educational quality with an ordinary least squares regression analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	285.021	56.048		5.085	.000
	Variation	63.659	14.148	.390	4.499	.000
	SES Grad	–.602	.506	–.099	–1.189	.239
	Autonomy	.393	.235	.154	1.669	.100
	Treatment	1.598	.537	.243	2.978	.004
	GDP Capita	.001	.000	.361	3.936	.000

a. Dependent Variable: Mean Reading 2009

ment procedures. Interestingly the assessment variables had only a weak relation to educational quality. Hence we decided to leave them out of the analysis.

Finally we include in Appendix A the per capita GDP for each country in the expectation that more economically developed countries will tend to have higher quality in their educational systems. The inter-correlations of per capita GDP with the variables noted above are modest to strong.

Towards a Model of Egalitarian Education

We propose the model as presented in Figure 1. Our principal interest is to determine if Egalitarian Treatment has a significant impact on Educational Quality once the other variables discussed above are included in the analysis. For this purpose we have utilized ordinary least squares.

The regression results for the prediction of Reading 2009 are presented in Table 1. The equation explains an impressive 62% of the variance (adjusted R-squared) in average quality. Egalitarian Variation in Reading and GDP per capita are the main predictors of Reading 2009 followed by egalitarian treatment; all are statistically significant at the .01 level. School Autonomy has a more modest impact. Finally, the indicator of Egalitarian Process (the SES gradient) does not have a significant impact. These results provide a strong affirmation of Egalitarian Treatment as one of the most important policies for enhancing educational quality.

What About Egalitarian Process?

As noted in the section on methods, OECD analysts have devoted considerable effort to developing new indicators of educational process, and in their report they have especially highlighted two such indicators: The percent of within School variance explained by SES and the slope of the gradient of SES. These variables seek to capture the extent to which the socioeconomic background of students influences their educational performance. Lower scores on these variables would signify the lower influence of SES.

These two variables are highly correlated with each other, yet neither has a significant rela-

tion to Reading 2009. Countries with a higher degree of influence of SES on student performance do not have lower scores on Reading 2009. Moreover, neither of these SES background variables has a significant relation to the relative presence of egalitarian treatments. What is going on?

In the development of the SES variables, OECD presents a number of graphs. One of these presents the distribution by SES gradient with the distribution by Reading 2009 (Figure II.3.4 on page 59 of Volume II). OECD argues that the countries should fall either in the top right quadrant (low slope, high performance) or the bottom left quadrant (high slope, low performance). Several important countries do fall in the top right quadrant, but the bottom left quadrant is virtually empty. The fact is that the majority of countries (including Japan) fall into the two remaining quadrants. Clearly OECD has encountered difficulty in depicting the role of SES background in educational performance as well as in accounting for the actual variability in SES background. This is an important area for further exploration.

One avenue worthy of further exploring is the type of school that young people are in. In the Japanese case, all of the sampled children are in the first year of upper secondary education, a level with competitive entrance exams. At this level in the Japanese system, SES begins to impact performance. In other systems many of the sampled children are in the Japanese equivalent of lower secondary where there is very little formal competition. This is an additional aspect of structural variation that the OECD analysis has not adequately considered.

How Egalitarian is Japanese Education?

Japan is frequently noted for its egalitarian approach to basic education (Cummings, 1980, 1982). Even so, the Japanese system is said to place obstacles in the way of many children, especially minorities and the foreign born (Okano, 1999). Additionally critics charge that Japanese education stresses conformity and thus stifles the creativity of young people.

The PISA 2009 reading survey does not directly address these critical observations. However, it does show in measure after measure that Japan scores towards the high end on egalitarian treatment and process. In this regard, Japan belongs in a small group with such educational super-stars as Finland, Iceland, Korea, and Norway.

Of course egalitarianism is not the only route to high quality. Singapore has a relatively in-egalitarian structure yet achieves high marks for educational quality. But it is difficult to identify another country that combines anti-egalitarianism and quality. Singapore is the exception rather than the rule; its small size and its skill in designing an effective curriculum may account for its unique path to success.

Japan is impressive in terms of Egalitarian Education through lower secondary, though at the upper secondary level as well as at admission to the tertiary level egalitarianism slips. Even so, Japan has fostered a relatively Egalitarian Society as have many of the other societies with egalitarian education.

Table 2 Considering the Asia effect

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	323.189	55.405		5.833	.000
	Variation	61.544	13.518	.377	4.553	.000
	SES Grad	–.991	.505	–.162	–1.963	.054
	Autonomy	.232	.233	.091	.999	.322
	Treatment	1.578	.512	.240	3.083	.003
	GDP capita	.001	.000	.337	3.828	.000
	Asia Dummy	37.820	14.437	.212	2.620	.011

a. Dependent Variable: Mean Reading 2009

An Asia Effect?

As noted earlier, some analysts have suggested there is an Asia effect in educational treatment and process. To consider this proposition, we added the Asia dummy variable to the equation underlying Table 2 (R-Squared increases to 65%). As seen below, the Asia dummy is significant at the .01 level while the pattern for the remaining variables is unaltered: that is, egalitarian variation, egalitarian treatment, and GDP per capita all have significant relations to Reading 2009 and in the hypothesized directions. This is a somewhat surprising finding considering that Singapore with its relatively in-egalitarian structure is included in the Asia group. There does appear to be an Asia effect up and above the other factors that are included in this study. This Asia effect may consist of such factors as the quality and training of teachers, the compensation they receive, the respect for learning in the region, and the emphasis that employers place on academic credentials. This is another theme that deserves further study.

Conclusion

OECD is conducting influential studies on the quality of contemporary education. The official reports present basic data and simple analysis. But they do not indicate which among several important variables might have the greatest impact on quality. This study reviews the evolution of modern education in order to highlight key variables: economic level, impact of Egalitarian Process (SES), School Autonomy, Egalitarian Treatment, and Egalitarian Variation. It finds that economic level and egalitarian treatment are the key variables influencing student performance. Additionally it finds that Asian systems have a measurable edge in educational quality.

The measure of egalitarian treatment developed for this study has four component indicators. Three of the four when taking separately have a strong relation to the PISA 2009 indicator of reading quality. Most notable is the absence of streaming and the minimal reliance on transferring students to alternate schools due to low performance or behavioral issues.

Japan is impressive in most of these themes. This is most probably due to the reforms immediately after WWII. But while Japan is strong on egalitarian education through the lower

secondary school level, inequality increases in the upper secondary and higher education levels. So for the future, we need to pay more attention to the upper levels of schooling as well as to the links between egalitarian education and egalitarian society.

Notes

1. Political Units might be more accurate, as in the Chinese case the study carried out field work at several units within China: Hong Kong, Macao, Shanghai; but not China as a whole.
2. Other methods for the scale construction were considered (e.g. Principle Components Analysis) but we decided on this simpler approach as it better highlights the actual components included in the scale. Using our simpler approach, we reviewed the options with 4, 3, and 2 indicators, but found all were highly inter-correlated so we settled on the 4 component option.
3. However, many of the American states instituted a "separate but equal" approach of racially segregated education that contradicted the espoused egalitarian treatment intent of American public education.

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Appendix A Measurements for the variables included in the study

Variable	Measurement
Quality	Country Average Score on Reading 2009
Egalitarian Variation	1 – Country Standard Deviation
Egalitarian Process	100 – SES Gradient
Egalitarian Treatment	100 – (Sum of the average percent who repeat, the average percent who are transferred, the percent of schools that employ ability grouping, and 7 times the number of tracks found at the upper secondary level in each system)/4
Autonomy	(Sum of the percentage of schools in each system that establish their own student assessment policies, the percentage that choose which textbooks are used, the percentage that determine course content, and the percentage that decide which courses are offered)/4
Gross National Product per capita	As reported by OECD
Asia	Japan, Korea, Singapore, Taiwan, Shanghai, Macao, and Hong Kong have values of 1; all other countries have value of 0

Appendix B Country values on key indicators

Country	Reading Mean 2009	Egalitarian Variation	Egalitarian Process	Egalitarian Treatment	Autonomy Average	GDP Per Capita
Australia	515	0.55	54	94.4	95.8	37615
Austria	470	0.38	52	75.4	83.0	36839
Belgium	506	0.55	53	67.5	89.0	34662
Canada	524	0.71	68	89.7	84.5	36397
Chile	449	0.31	69	78.9	84.0	14106
Czech Republic	478	0.39	54	83.0	99.3	23995
Denmark	495	0.58	64	94.2	90.8	36326
Estonia	501	0.48	71	91.4	97.5	20620
Finland	536	0.57	69	96.8	92.8	35322
France	496	0.31	49	67.5	89.0	32495
Germany	497	0.46	56	78.9	88.5	34683
Greece	483	0.11	66	84.6	15.8	27793
Hungary	494	0.35	52	87.7	89.0	18761
Iceland	500	0.72	73	95.3	93.3	36325
Ireland	496	0.40	61	87.5	91.3	44381
Israel	474	0.24	57	83.1	96.5	26444
Italy	486	0.67	68	82.3	89.5	31016
Japan	520	0.33	60	91.1	98.5	33635
Korea	539	0.35	68	91.6	98.0	26574
Luxembourg	472	0.72	60	54.6	73.5	82456
Mexico	425	0.53	75	77.1	43.8	14128
Netherlands	508	0.00	63	66.3	99.3	39594
New Zealand	521	0.54	48	95.0	99.3	27020
Norway	503	0.48	64	95.6	74.5	53672
Poland	500	0.48	61	93.9	92.8	16312
Portugal	489	0.37	70	83.8	48.5	22638
Slovak Republic	477	0.48	59	81.1	96.5	20270
Slovenia	483	0.79	61	87.6	92.0	26557
Spain	481	0.58	71	85.9	75.3	31469
Sweden	497	0.42	57	94.1	91.8	36785
Switzerland	501	0.52	60	72.3	74.8	41800
Turkey	464	0.25	71	75.8	40.3	13362
United Kingdom	494	0.53	56	95.2	99.5	34957
United States	500	0.26	58	89.7	88.8	46434
Albania	385	–0.04	69	84.3	64.0	8090
Argentina	398	–0.16	60	75.6	75.3	13243
Azerbaijan	362	0.09	79	86.3	49.3	8090
Brazil	412	0.34	72	79.5	66.8	10770
Bulgaria	429	–0.56	49	79.9	55.3	11249
Colombia	413	0.10	72	73.0	81.5	8515
Croatia	476	0.39	68	80.8	62.0	18337
Dubai (UAE)	459	0.76	49	77.4	77.3	5007
Hong Kong-China	533	0.61	83	86.9	99.5	42178
Indonesia	402	0.08	83	78.5	88.0	3727
Jordan	405	0.19	76	73.6	12.5	5007
Kazakhstan	390	0.21	62	80.3	43.8	10917
Kyrgystan	314	–0.02	60	77.7	67.8	1994
Latvia	484	0.38	71	89.2	82.5	17397
Liechtenstein	499	0.44	74	88.4	72.5	34662
Lithuania	468	0.49	67	90.0	93.5	17933
Macao-China	487	0.82	88	70.3	99.0	52691
Montenegro	408	0.58	69	85.3	50.5	12476
Panama	271	–1.40	69	80.6	64.3	11381
Peru	370	–0.08	59	76.2	73.0	7682
Qatar	372	0.78	75	68.8	52.0	5007
Romania	424	0.03	64	78.2	82.0	11673
Russian Federation	459	0.28	63	81.0	83.5	14765
Serbia	442	0.46	73	79.0	56.5	10270
Shanghai-China	556	0.57	73	84.1	77.0	5340
Singapore	526	0.79	53	89.7	93.3	51462
Taipei-Chinese	495	0.47	64	83.6	95.5	17154
Thailand	421	0.38	78	88.4	99.0	7722
Trinidad and Tabago	416	0.71	62	78.6	83.3	24541
Tunisia	404	0.28	81	80.2	13.3	7637
Uruguay	426	0.39	63	83.5	47.5	11429

Appendix C Inter-correlations of key indicators

		Read Mean	Variation	Process	Treatment	Autonomy	GDP per_ cap	Asia
Reading Mean 2009	Pearson Correlation	1	.611**	–.222	.363**	.513**	.614**	.374**
	Sig. (2-tailed)		.000	.076	.003	.000	.000	.002
	N	65	65	65	65	65	65	65
Variation	Pearson Correlation	.611**	1	.031	.151	.277*	.400**	.201
	Sig. (2-tailed)	.000		.807	.229	.025	.001	.109
	N	65	65	65	65	65	65	65
Process	Pearson Correlation	–.222	.031	1	–.025	–.303*	–.228	.186
	Sig. (2-tailed)	.076	.807		.845	.014	.067	.138
	N	65	65	65	65	65	65	65
Treatment	Pearson Correlation	.363**	.151	–.025	1	.289*	.040	.107
	Sig. (2-tailed)	.003	.229	.845		.020	.752	.397
	N	65	65	65	65	65	65	65
Autonomy	Pearson Correlation	.513**	.277*	–.303*	.289*	1	.417**	.275*
	Sig. (2-tailed)	.000	.025	.014	.020		.001	.026
	N	65	65	65	65	65	65	65
GDP per capita	Pearson Correlation	.614**	.400**	–.228	.040	.417**	1	.195
	Sig. (2-tailed)	.000	.001	.067	.752	.001		.120
	N	65	65	65	65	65	65	65
Asia	Pearson Correlation	.374**	.201	.186	.107	.275*	.195	1
	Sig. (2-tailed)	.002	.109	.138	.397	.026	.120	
	N	65	65	65	65	65	65	65

**. Correlation is significant at the 0.01 level (2-tailed).