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Worth narrowing the educational gap between South Korea and Sweden? A comparative analysis of PISA 2015

Introduction

It has been known for about a decade that South Korea is one of the top performers and Sweden is a middling performer in the Programme for International Student Assessment (PISA) assessments, where approximately 5000 15-year-olds in each of the 65–75 different countries take a test in mathematics, science and reading literacy under the aegis of the Organization for Economic Development and Cooperation (OECD). PISA can be used as a benchmark in international comparative education for a variety of purposes, and to test educational outcomes or 'quality' more generally (Hanushek 2012). While South Korea performed less well in PISA 2015 (OECD 2015) compared to 2003, 2006, 2009 and 2012, the gap between Sweden and other average performers is still substantial.

When educational researchers, sometimes linked to economics or psychology, aim to understand why some countries perform better than others they will examine factors that underlie the PISA performance, such as educational quantity, class size, teachers' cognitive skills and salaries, students' cognitive abilities (intelligence quotient, IQ), and educational expenditure. In the current study I have compared South Korea and Sweden based on middle school curricula, national IQ scores, gross domestic product (GDP) per capita and public spending on education, educational quantity, academic stress and well-being among students, academic achievement in relation to employment rates, and immigration and ethnic heterogeneity, influenced in particular by Rindermann et al. (2016) and Lynn and Vanhanen (2012). Some of the selected variables are such that might be included in any cross-national comparative study while some are more specific. For instance, immigration and ethnic heterogeneity are important to examine since Sweden is a heterogeneous country

while South Korea is quite homogenous. Moreover, since the media tends to emphasize the overload of work signified in the lives of South Korean adolescents (Viktorsson 2016), educational quantity and academic stress are of particular significance.

Since this study is considered for publication elsewhere, I have only included the results and excluded the longer introduction, vast literature review, tables, and method and data sections. However, one variable which was omitted in the article considered for publication in an educational journal, curriculum comparison, has been included here.

The History of Education in South Korea

South Korea has made a rapid development from a Confucian to a democratic society. This process has implied that educational opportunities were extended from a small elite to virtually all segments of society within the span of five decades, although formal class inequality was eroded in the late nineteenth century in the aftermath of Western influences that were retrieved from Japan, prior to and during the colonial period (1910–1945), when Korea was annexed by Japan (Chang, 2010; Lie, 2014).

In 1945, the literacy rate in Korea was only 22 percent whereas by the time that the democratization process was implemented in the late 1980s more than 93 percent of South Koreans could read. "Education remained the single most important factor affecting social mobility in the 1990s" (Savada and Shaw, 1992). This has occurred in conjunction with rapid urbanization and Westernization (Baker, 2003). In 2009, South Korea had net private returns from attaining tertiary education at the average level of OECD (160 000 USD) (OECD, 2013).

As Sava & Show note (1992: 114), the curriculum is largely based on American standards: six years of primary school, six years of secondary school (middle school and high school), and four years of higher education (college or university). Furthermore, the curriculum of mathematics has been revised nine times since independence in 1945. The latest revision was implemented in 2011 to address the problem with memorized knowledge and negative attitudes toward mathematics, as well as to foster greater character and creativity (National Academies of Sciences, Engineering, and Medicine, 2015).

An Americanized model remains a fundament for the current curricula and broader educational system. There are some historical links between the Confucian past and post-Confucian present, such as the elitist mindset in regard to education (Jonsson 2018, 58), but overall South Korea has become highly westernized. Meritocracy in South Korea

is to be regarded as a capitalist element rather than reminiscent of the Confucian literati of the Chosun dynasty (Lie, 2014). Yet, the older generations tend to represent the Confucian residues, such as family values, hierarchical social structures, and proper social etiquette (Jang and Kim 2013). However, the greatest external pressure on students stems from low-fertility middle- and upper-class urban families who make major economic and emotional investments in their children's socioeconomic futures (Hultberg et al., 2017).

The History of Education in Sweden

An important development of education in Sweden occurred when the public school bylaw (Folkskolestadgan) was implemented in 1842. The subjects in the general curriculum included reading, writing, calculation, geography, history, science, physical education, singing, Christendom education, and Biblical history. While poverty, unclear regulations, and poor infrastructure contributed to low participation rates throughout the nineteenth century, the population (despite significant emigration to the United States), education system, and participation rates grew steadily. As of the year 1900, approximately 10 100 elementary schools were recognized, compared to only 1718 in 1870 (Richardson, 2010: 50–72).

Due to the cumulative processes of democratization, modernization and emancipation of women (Stanfors, 2003), as well as the growth of material wealth and prosperity in the early twentieth century, the education system was reformed numerous times between 1900–1970. Increased secularization paved the way for non-confessional education from the 1950s onward. However, the major reforms, such as the introduction of the current version of upper-secondary education and municipal adult education, were introduced around 1970 and the regulations have been relatively stable ever since (Richardson, 2010: 89–140). The curricula have been revised several times. The last major revision for the entire school system was launched in 2011, with a partial revision in 2018. Sweden offers six years of mandatory elementary school and three years of middle school education, three years of non-mandatory upper-secondary school, and three to five years of higher education (Skolverket, 2018a). In 2009, Sweden had net private returns from attaining tertiary education way below (80 000 USD) the average level within the OECD (160 000 USD) (OECD, 2013).

Other crucial changes between 1970–2010 have been the high participation rates at universities, several revisions of the educational program for teachers, and a large influx of migrants from the Balkans, Middle East,

and Africa. For instance, out of 135 945 students who studied their home language in elementary school or middle school in 2007/2008, 27 940 studied Arabic (20.5%) (Richardson, 2010).

Curriculum Contents in South Korea and Sweden

When establishing discursive patterns within educational policy documents, at the middle school level of education, it may be fruitful to combine elements from both discourse analysis and content analysis (Krippendorff, 2018; Laclau and Mouffe, 2001). Content analysis may include quantitative elements such as the amount a word is included in a given text (Krippendorff, 2018) but related to what some discourse theorists refer to as the discursive field. Such potential nodal points, i.e. privileged signifiers, are constituted as partially fixed elements within a discursive field (Laclau and Mouffe, 2001: 105–114).

In relation to official policy documents, such nodal points may be for example *democracy*, *knowledge*, *equality*, *skills* and *character*. A reason why such an analytical point of departure is not merely a prejudice or preconception is that already within the first pages of the School Curriculum of the Republic of Korea and the Swedish counterpart, Curriculum for the Compulsory School, Preschool Class and School-age Educare, knowledge and democracy are mentioned multiple times and appear to have privileged or salient positions. Perhaps *knowledge* is such a basic concept that it becomes trivial, much like terms such as *learning* or *education*, but to which degree knowledge is emphasized and in connection to which other discursive elements matter. However, as one reads and analyzes the entire documents, several nodal points may be discerned. Both such nodal points include those which are similar within the South Korean and Swedish national curricula and those that differ.

Apart from general guidelines, related to fundamental values and goals, as well as the curriculum subjects, I will specifically focus on mathematics as a subject. A reason for this is that South Koreans perform significantly better in mathematics and hence it is relevant to understand the general content within the two national curricula. Furthermore, if the study were to include all three PISA subjects it would become too extensive, and it is indeed difficult to compare education in Korean and Swedish, which is related to reading aptitude. Science is excluded due to limitations. In relation to South Korea, I will use the Korea Institute for Curriculum and Evaluation (KICE) and the summary, in English, conducted by Sang et al. (2015) and World Data on Education (2011). In regard to Sweden I will use the Swedish Curriculum for the Compulsory

School, Preschool Class and School-age Educare (Skolverket, 2018a).

South Korea

The general educational objectives in South Korea are to develop individuality on the basis of fostering a "well-rounded character"; demonstrating creativity with a solid foundation in basic knowledge and skills; exploring career paths on the basis of broad intellectual faculties; creating new values which hinge upon the national culture; and contributing to the community through democratic citizenship. The goals in middle school education are to promote a well-balanced development of mind and body; help students foster problem-solving skills for learning and everyday life and to equip them with the ability to express thoughts and feelings; to inculcate national pride; and to cultivate an understanding of fundamental values and democratic principles. The nine subjects in middle school are Korean language, moral education, social studies, mathematics, science, practical studies, technical studies/home economics, physical education, music, art, foreign language (English), autonomous activities, and extracurricular activities (World data on education, 2011).

In regard to mathematics, the 2009 mathematics curriculum for middle school comprises five content domains: numbers and operations, variables and expressions, functions, probability and statistics, and geometry. Further:

> The Korean national curriculum deals with Information and Communications Technology-supported instruction. The mathematics curriculum refers to the use of technological aids to help students perform complicated computations when the focus of instruction is not on developing students' computational skills (e.g., performing the four arithmetic operations). Technological aids are believed to facilitate a deeper understanding of mathematical concepts. In particular, the use of calculators, computers, and educational software is recommended to help students not only to do complicated calculations but also to understand mathematical concepts, principles, and laws. Calculators, however, are not to be used in the classroom for teaching, learning, or developing calculation skills (Sang et al 2015).

Sweden

In the Swedish Curriculum for the Compulsory School, Preschool Class and School-age Educare (2018a), the fundamental values and goals are presented:

> The school should stimulate pupils' creativity, curiosity and self-confidence, as well as their desire to translate ideas into action and solve problems. Pupils should have the opportunity to take initiatives and assume responsibility, and to develop their ability to work both independently and together with others (Ibid: 8).

An environmental perspective provides opportunities not only to take responsibility for the environment in areas where they themselves can exercise direct influence, but also to form a personal position with respect to overarching and global environmental issues. Teaching should illuminate how the functions of society and our ways of living and working can best be adapted to create sustainable development. It is important to have an international perspective, to be able to understand one's own reality in a global context and to create international solidarity, as well as prepare for a society with close contacts across cultural and national borders. Having an international perspective also involves developing an understanding of cultural diversity within the country. An ethical perspective is of importance for many of the issues that are taken up in the school. This perspective should permeate schooling in order to provide a foundation and support pupils in developing their ability to form personal standpoints and to act responsibly towards themselves and others (Ibid: 8).

Regarding mathematics, the general description of the content is as follows:

> Teaching should help pupils to develop their knowledge in order to formulate and solve problems, and also reflect over and evaluate selected strategies, methods, models and results. Pupils should also be given the preconditions to develop knowledge to be able to interpret situations in daily life and mathematics, and also describe and formulate these by using mathematical forms of expression. Through teaching, pupils should be given the preconditions to develop their familiarity with basic mathematical concepts and methods, and their usefulness. In addition, through teaching pupils should be given opportunities to develop knowledge in using digital tools and programming to explore problems and mathematical concepts, make calculations and to present and interpret data. Teaching should help pupils to develop their ability to argue logically and apply mathematical reasoning. Pupils should through teaching be given the opportunity to develop familiarity with mathematical forms of expression and how these can be used to communicate about mathematics in daily life and mathematical contexts. Teaching should give pupils the opportunities to develop knowledge

> about historical contexts where important concepts and methods in mathematics have been developed. Through teaching, pupils should also be given opportunities to reflect over the importance of mathematics, its use and limitations in daily life, in other school subjects and in historical processes, and as a result be able to see the context and relevance of mathematics (Ibid: 55).

Furthermore:

> Teaching in mathematics should essentially give pupils the opportunities to develop their ability to: formulate and solve problems using mathematics and also assess selected strategies and methods, use and analyse mathematical concepts and their interrelationships, choose and use appropriate mathematical methods to perform calculations and solve routine tasks, apply and follow mathematical reasoning, and use mathematical forms of expression to discuss, reason and give an account of questions, calculations and conclusions (Ibid: 56).

Key Similarities

Some of the major similarities between South Korea and Sweden are the focus on knowledge, democratization, internationalization, and subject content. Both curricula emphasize the importance of non-cognitive abilities (or character skills), such as creativity and confidence, as well as cognitive skills such as problem-solving skills and mathematical knowledge. The values and multi-faceted curricula contents appear to reflect a modern humanitarian discourse, although the element of national pride in South Korea may reflect a hybrid discourse (humanitarian-nationalist). (For a critical discussion about the curriculum in history, see Kim, 2018.)

Key Differences

Subject-wise, in South Korea mathematics is divided into algebra and geometry, whereas in Sweden they are integrated into a singular subject. The mathematical content appears to be slightly more advanced in the Swedish curriculum, although it may sound more advanced than it tends to be in practice. Moreover, the South Korean curriculum underscores that the use of calculators in the classroom is prohibited, which may foster greater arithmetic skills. These may be somewhat useful in relation to PISA tests.

Furthermore, ethics and *hanja* (Chinese characters) are not part of the Swedish equivalent, although some schools offer basic Chinese (Skolverket 2018a: 69–72) and ethics are sometimes implemented in religious

education or within the other subjects. Moreover, moral education (ME) is not included in the Swedish curriculum, at any level of the education system. Perhaps ME has assisted in the inculcation of character skills to a greater degree than in the Swedish population, whereas emphasis on gender stereotypes and environmental issues might be important values but have no direct significance for achievement in PISA assessment.

National IQ and PISA Scores

Due to high intercorrelations (0.5–0.8), both Rindermann (2007) and Lynn and Vanhanen (2012) have used scholastic aptitude tests such as PISA and TIMSS as substitutes for IQ or vice versa, which showcases circular reasoning (Heckman and Kautz 2014; Nisbett 2010). Fortunately, IQ scores from Lynn and Vanhanen (2012) consist of a differentiation between these two measures. According to Georgas et al. (2003), South Korea has an average national IQ of 100, whereas Sweden has an average national IQ of 99. South Korean 15-year-olds have a mean result of 516 in science, 517 in reading, and 524 in mathematics, whereas their Swedish equivalents have 493, 500 and 494. The median test score difference is 23 points, in favor of the South Korean sample (OECD, 2015: 7).

Lynn and Vanhanen (2012: 11–17) have discussed how the SAT scores and IQ should be scaled properly and suggest a 500/100 metric. 500 is the PISA mean within all aggregated OECD countries, whereas an IQ level of 100 is the median raw score linked to the UK population as a guideline. The IQ is adjusted to account for the Flynn effect; the broader tendency which manifests that measured IQ scores have increased throughout the twentieth century. SAT scores are somewhat more culturally biased than IQ scores, since only individuals who stay in school take scholastic aptitude tests, whereas IQ test subjects include fractions of people who do not attend any school or level of education. However, since the intercorrelation is as high as the average between two different IQ tests, it does not cause any major measurement error or bias (Ibid.)

The general scaling guideline is largely intercorrelated with the expected IQ scores and vice versa, although Swedish test subjects perform somewhat lower than expected in science and mathematics, and slightly higher than expected in reading. South Koreans perform slightly better than expected in science, reading and math. A correlation between national IQ scores and PISA scores indicates that the former can entirely predict the latter in both countries (SK $r = 0.97$ in reading, $r = 0.97$ in science, and $r = 0.96$ in mathematics. SW $r = 0.99$ in reading, $r = 0.99$ in science, and $r = 0.99$ in mathematics).

13.6 percent of the variance of decline in PISA reading (2000–2012), 6.7 percent of PISA mathematics (2003–2012), and 25,1 percent of PISA science (2006–2012) are linked to migrant participation (Skolverket 2016: 46). Since there is a lag between immigrant-related performance declines, and temporal variations between the analyzed data sets, one should be hesitant to highlight these as exact numbers. Based on the available data, however, 15 percent or 3.45 points of the total decline of the 23-point median score difference between South Korea and Sweden may be attributed to migrant participation.

GDP Per Capita in Relation to Public Spending

If one mainly measures economic growth in GDP per capita and relates its educational achievement it appears as if Sweden has not suffered to a significant degree, despite lower PISA scores. However, as Sanandaji (2018) notes, the GDP per capita growth rates in Sweden have been meager, roughly 1-2 per cent annually since the last financial crisis in 2008. This may or may not be associated with decreases in PISA results. Nevertheless, despite the low performance relative to South Korea, Sweden's GDP per capita remains roughly 40 percent higher. A possible explanation is the developmental lag that South Korea faces relative to developed nations like Japan and those of Western Europe and the United States, which began their economic developmental processes several decades prior to South Korea (te Nijenhuis, 2012; Chang, 2010).

The percentage of GDP per capita spent on the public education sector does, at first glance, appear to be positively correlated with educational achievement since South Korea spends 0.7 percent more on education. However, South Korea has a significantly larger private spending on education, which masks eventual public funding benefits (Hultberg et al. 2017; Oh 2010; Kim 2010). For example, South Korean 15-year-olds spend 17.63 percent of their weekly 69.48 hours in cram schools (Ahn and Baek 2012), solely funded by parental expenditures, while no such measured effects have been established for their Swedish counterparts. In 2007, South Korean parents spent on average 220 USD per month on private tutoring. South Korea has the highest private educational spending among all OECD nations and Sweden is not among the top ten in this regard (Oh, 2010: 309–310); it is definite that South Korean parents invest significantly more than their Swedish counterparts. Therefore, PISA scores in relation to educational quantity are partly mediated by private spending.

Quantity of Education

The best estimate of the average number of daily hours spent on education (school, homework and private tutoring) for South Korean 15-year-olds is established by Ahn and Baek (2012) and SCB and Skolverket (2018b) for Swedish 13-16-year-olds in middle school education. The data shows that Korean 15-year-olds on average spend 69.48 hours per week, whereas their Swedish counterparts spend 40 hours per week. South Korea's middle school education consists of 46 active school weeks (46 x 69.48 = 3196.08). Swedish middle school students spend 40 weeks in school and eight hours on schoolwork (6.7 hours in school and one hour for homework), on average (40 x 40 = 1600). At first glance the figure 1600 annual hours appears rounded off and less accurate. Furthermore, it does not include the less common yet somewhat widespread trend of increased supplementary private education in Sweden. However, to adjust for such trends I have added 100 annual hours (2.5 hours x 40 weeks) on top of 33.5 weekly regular school hours and 260 annual hours of added homework to fill the approximate 40/40 model. This implies that annually, Sweden does only spend roughly 50 percent of the amount of schoolwork relative to South Koreans.

Earlier research (Andersen et al. 2016) suggests that increased instruction time is positively associated with academic performance. However, one may suspect that 220 days and almost 3200 hours spent on schoolwork are suboptimal, both at the individual and national level in contemporary South Korea. That is because the larger society does not benefit from a hyper-competitive situation in which a large share of adolescents struggle for a limited number of positions at the elite universities (Hultberg et al., 2017). Individuals may suffer from increased levels of stress and relative sleep deprivation (Ahn and Baek, 2012), which may even impair achievement. In that respect Swedes have a better situation, while 178 instruction days appears too low a figure and more hours dedicated to schoolwork may increase results in regard to both grades and PISA scores. As Andersen et al. (2016) show, instruction time is positively associated with educational attainment. Given the totality of annual number of school hours, one has reason to believe that almost 3200 hours spent on education appears suboptimal for both well-being and performance.

Quality of Education

Three relevant indicators of educational quality are average class sizes, average teacher salaries, and disciplinary climate (related to attentiveness). The data shows that South Korea has an advantage in comparison

to Sweden in regard to average teacher salaries and disciplinary climate, but that Sweden may benefit from smaller average class sizes. However, earlier research suggests that this difference may not be very substantial.

Salary differences are striking, with a 42 percent advantage for the most well-paid Korean teachers. That gives Koreans incentives to compete for attractive teaching positions, whereas Swedes may choose other and more well-paid and locally status-oriented vocational fields. Further evidence suggests that teachers in Sweden partly are selected among low-performing groups (SVT 2014).

Academic Stress and Sleep Deprivation

Ahn and Baek (2012) report that 43 percent of South Korean 15-year-olds experience "serious stress" levels. This estimate is not completely equivalent to Swedish levels where 52 percent experience unspecified academic stress. However, it is conspicuous that a large share of Swedish students is stressed despite the relatively low educational quantity.

A further problematic aspect of such a comparison may be linked with reference bias. For instance, Heckman and Kautz (2014: 352–355) note that South Koreans tend to define themselves as "lazy" and unconscientious, despite working the most hours within the OECD after Japan. Therefore, self-reported academic stress levels must be controlled for educational quantity and suicide rates. It makes more sense that South Koreans really are more stressed.

Academic Achievement in Relation to Employment Rates

OECD (2018) measures the return on investment from obtaining tertiary education. The data shows that 74 percent of Koreans who have obtained tertiary education are employed, whereas 84 percent of Swedes are employed based on the same measure. This supports the Hultberg et al. (2017) notion that the South Korean education system is partly ineffective or counterproductive relative to Sweden and other countries.

Immigration and Ethnic Heterogeneity in Relation to Educational Achievement

At this point, Sweden has a much greater level of ethnic heterogeneity; 20 percent non-natives compared to only four percent of foreign-born individuals in South Korea. A positive side-effect of increased immigration is the influx of high-performing individuals, but the net effects for Sweden as a host nation have been negative from the 1990s onward (Ekberg 1999; Sanandaji 2018). This suggests that an optimal immigration

and integration policy, in conjunction with a highly effective education system, are required to counter a decline in PISA and other measures of educational performance. Therefore, South Korea faces a better situation in that respect. However, it is projected that ethnic diversity will increase in the coming decades. This may or may not be beneficial for the country.

Conclusion

An intriguing phenomenon to investigate is *why* South Koreans have higher PISA scores, but the curriculum characteristics provide few clues in that regard. On the other hand, the data presented in this study show that South Korean middle school students spend significantly more time doing schoolwork compared to Swedes, which will likely affect the ability to absorb more knowledge. Such an explanation is supported by both the survey of Andersen et al. (2016), although Nisbett (2010) emphasizes increased stress as detrimental for cognitive function and development. Perhaps South Korean students and pupils are more stressed than the Swedish equivalents due to greater social pressure and therefore perform slightly lower than expected. There is a trade-off in educational quantity and Finland, which overall performs better than South Korea in PISA despite having lower total annual educational quantity, appears to have a more optimized and effective education system (Ahn and Baek 2012). On the other hand, perhaps Korean schools are less stressful than many Swedish schools, at least those schools in Sweden which are characterized by low results and a lack of peaceful learning environments. 52 percent of middle school pupils (grades 7–9) in Sweden suffer from school-related stress, linked to tests and homework. 43.2 percent of South Korean youths, on the other hand, suffer from "serious stress". Such slightly unspecified self-reports will only offer a rough comparative value. Nevertheless, the data from PISA 2015, at least, indicate that South Korean 15-year-olds possess emotional stability to the extent that they are able to perform well on international assessments.

Even though the educational system in South Korea has its apparent flaws and should not be emulated in its entirety, it appears as if Sweden could be favored by at least slightly more diligent students, as well as higher education quantity, such as more annual school hours of mathematics, relevant homework, and even private tutoring. Since Sweden is a well-developed welfare state it can provide more subsidized private tutoring for the population in its entirety, rather than relying solely on parental initiatives. Moreover, the education of competent teachers

should be another priority. Perhaps the high quality of teachers is South Korea's greatest benefit, whereas IQ differences appear negligible. On the other hand, the large GDP per capita differences in favor of Sweden demonstrate that South Korean achievement levels may have reached a threshold value of diminishing returns.

For South Korea, a less-cutthroat approach to education and counter-productive private spending is required. Many of these suggestions have been discussed by Hultberg et al. (2017) and include less reliance on university entrance exams and an aim to favor occupations which do not require university degrees. While such a redirection may potentially decrease international test results in the short term, and hurt some of the national pride, it would likely be worthwhile.

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