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EQUITY NOTES FROM THE FIELD

As educators, policy makers, and researchers work toward establishing more equitable practices and outcomes in mathematics, it is important that these recommendations and practices be incorporated in mathematics spaces near and far. The following research articles cover a range of focused issues relevant to mathematics educators that are pertinent for our understanding and strive for equity.

Factors Affecting Mathematics Achievement Gaps in Korea

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The purpose of this paper is to describe the achievement gap in Korea. Despite the success in Korea's economy and education within a short period, deepening disparity of economic wealth has given rise to a critical issue of an achievement gap. The primary results of this study found that the determinants of the achievement gap in Korea include socioeconomic status [SES], regional factors, and private education. Independently or in combination, these three factors seem to have an influence on the differentiation of student achievement. It was revealed that parents' academic background and family income are closely correlated with student achievement, and students from urban areas score much higher than those from rural areas. Although students with a higher level of achievement spend more time and money on taking non-school private lessons than the lower level of students, private education has little impact on the improvement of achievement scores. Finally, this paper discusses the educational policies to narrow the gap in student achievement in Korea.

Keywords: achievement gap in Korea, equity in mathematics, socioeconomic status, regional factors, private education.

Introduction

In the 1960s after the Korean War (1950–1953), Korea was one of the poorest countries in the world. The result of rapid economic development in the last half century left Korea ranked 15th in gross domestic product (GDP) and 12th in purchasing power parity (PPP) in 2011 (World Bank, 2012). This economic success has been achieved in large part due to Koreans' high enthusiasm in support of education. In mathematics achievement, Korean students ranked top among 57 countries that participated in the Program for International Student Assessment (PISA) in 2006 and second among 65 participating countries in 2009 (OECD, 2006, 2009). Furthermore, the Trends in International Mathematics and Science Study (TIMSS) ranked Korean student mathematics performance second place among 50 participating countries in 2007 (IEA, 2008).

Several decades ago, education in Korea had been considered an effective means to make possible the elevation of one's socioeconomic status. It was believed that through education, even children from poor families could perform more outstandingly than those from wealthy families. However, rapid economic development has given rise to the polarization of the social classes and resulted in making the education gap wider. In other words, family

income and parents' educational background tend to have much more influence on student achievement than in the past. Thus, students from poor families are faced with more difficult conditions in mathematics performance than those from wealthy families, compared with those in the past.

Traditionally, educational equality has been viewed as equality of educational opportunities, equality of educational conditions, and equality of educational results. However, the recent meaning of education gap (e.g., Achilles, Finn, & Bain, 1998; Kim, 2002) is more closely defined as the gap of achievement results between different groups of students, focused on the equality of educational results. The education gap is also used to mean the minimum requirement that all students should achieve based on curriculum guidelines. Hence, it is true that the discussion of the education gap has been concentrated on the gap of results, that is, the gap of student achievement (Kim 2005).

It is known that the most important determinants of the achievement gap in Korea include socioeconomic status, regional factor, and private education (Kim, 2005; Lee & Kang, 2004; Lee & Park, 2007). In the next sections, this article describes how the three determinants are related to the achievement gap in Korea and briefly discusses educational policies to narrow the achievement gaps.

EQUITY NOTES FROM THE FIELD

Impact of Socioeconomic Status

The student achievement gap among different social classes is a critical educational problem in Korea (e.g., Lee & Park, 2007; Park & Do, 2005). According to Coleman (1966), students' achievement is mostly influenced by their socioeconomic background but little by school factors, such as school facilities and teacher quality. Since the Coleman Report, there has been a significant amount of debate about whether the student achievement gap is the result of differences in socioeconomic status [SES] outside of school or factors housed inside of schools. From this perspective, parents' SES seems to have a significant impact on student achievement, while factors inside schools, such as educational systems and the quality of teachers, have considerable influence on student achievement. Due to the impact of parents' SES, lower-income students are faced with more disadvantageous educational conditions than higher-income students, resulting in the decline of their achievement level.

In Korea, studies about the relationship between parents' SES and student achievement began recently (e.g., Kim, 2005; Korea Institute for Health and Social Affairs, 2007; Lee & Park, 2005, 2007; Park & Do, 2005). Among them, research by the Korea Institute for Curriculum and Evaluation (KICE, 2011) revealed that parents' academic background is positively correlated with student achievement, and this tendency is strengthened as they go into higher grades. This finding is generally supported by another study (Kim, 2005), in which parents' SES was measured by parents' academic background and family income. As shown in Table 1, Kim pointed out that students with parents with graduate school degrees scored 17.3% higher in the college scholastic ability test in 2005 than students with parents having just middle school graduation. It was also revealed that students from high-income family group scored 10.4% higher than students from low-income families in the college scholastic ability test (p. 736). This data shows clearly the high correlation between parents' SES, measured by parents' academic background and family income, and student achievement. Particularly, the

Table 1. Parents' Academic Backgrounds and Achievement in 2005

Parents' Academic Backgrounds	Average Scores at College Scholastic Ability Test
Graduate Schools	328.41
College Degrees	310.66
2-year College Degrees	299.75
High School Graduation	294.82
Middle School Graduation	279.86
Total Average	298.56

parents' academic background was found to be more influential on student achievement than family income.

Education has a very special meaning to family in Korea. In this context of high educational fervor, both parents' educational background and income play the significant role for providing their children with better educational environments. Hence, there are increasing concerns that education may play a role in deepening social inequality and the resulting more serious achievement gap.

Impact of Regional Factors

Together with SES, one of the most sensitive issues about educational achievement in Korea involves the differences in student performance found between geographic regions in Korea. Research on the regional differences in educational results began relatively recently, because empirical studies have been very difficult to conduct due to parents' sensitivity to reporting educational results by region. While regional factors in the U.S. are connected to the gap in residential conditions of races, in Korea the debate of a regional gap is centered on the gap between the urban areas and the rural areas in educational conditions and achievement. That is to say, the issue is focused on the gap of educational results caused by the gap of educational conditions between the urban and the rural areas.

However, achievement gap between the city and the rural areas is closely related to the education gap by the SES. In the past, there was little achievement gap between the different regions in Korea since all people were poor and there was no concept of middle class in society. Following economic success, residential differentiation between middle and high class and lower class has been deepened. People with similar educational background and economic ability began to live together. Hence, students in the richer areas are able to study in a better educational environment than those in the poor areas including the rural areas, which results in the significant education gap in achievement. As this social phenomenon has a significant influence on student achievement, it is revealed that the regional factor is highly correlated with student achievement in Korea.

Table 2 indicates that students in the metropolitan cities scored 15.1% higher in college scholastic ability test in 2005 than students from the rural areas. This result demonstrated that there is a clear gap in student achievement between the urban areas and the rural areas. In other words, regional factors become the critical determinant to predict the achievement gap in Korea. The reason for this achievement gap between the urban and the rural areas is partly because excellent students tend to move to cities to receive better education, resulting in lowering the achievement level of the rural areas. For instance, many students move to 'Gangnam' (rich area of Seoul) to receive a good education, and thus

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Table 2. Achievement Difference between Regions (Kim, 2005)

Regions	Average Score at College Scholastic Ability Test
Seoul (The Capital)	303.49
Metropolitan Cities	310.31
Small Cities	298.80
Rural Areas	269.69
Total Average	298.56

there is a significant achievement gap between *Gangnam* and other areas.

After all, the achievement gap caused by regional factor can be explained by the close relationship of the region with both SES factor and residential differentiation. Because parents with high levels of academic preparation and high socioeconomic status prefer to move to well-to-do areas with better educational environments, residential differentiation in educational environment has deepened the results of student achievement. However, residential differentiation does not imply a difference in the quality of school policies and facilities and the quality of teachers.

Impact of Private Education

Since private education provided in non-school settings, called *Hagwons*, was allowed in the late 1980s, the percentage of students taking private education has sharply increased. For instance, while only 31 percent of middle school students enrolled in private education in 1990, 74.6 percent of middle school students were enrolled in private education in 2007 (Statistics Korea, 2008). One of the biggest reasons for this phenomenon can be found in parents' dissatisfaction with the quality of public education and their strong belief about the positive effects of private education on student achievement. However, the fervor of private education has given rise to the biggest social and educational issue because private education is greatly

influenced by parents' income, causing educational inequity and the significant gap in student achievement. Thus, narrowing the education gap caused by private education becomes the important educational issue to be solved in Korea.

First of all, it was shown that the total cost of private education is highly dependent upon family income level and parents' academic background. According to Statistics Korea (2008), high-income families spend more than twice as much as the average family does for private education and almost ten times as much as the poorest families do. Likewise, Statistics Korea shows that the higher the level of education parents receive, the more money they spend on their children's private education. In addition, families in the urban areas spend on children's private lessons much more than those in the rural areas do, resulting in a big difference in terms of the total cost of private education by the region. Hence, it seems clear that private education is significantly influenced by parents' SES and regional factors.

Table 3 shows the relationship between the expenditure on private education and participation percent by achievement levels in 2007 (Statistics Korea, 2008). Based on Table 3, the levels of student achievement are closely related to the cost of private education in that the top 10 percent of students spend \$322.9 for private lessons each month, whereas the bottom 20 percent of students spend only \$129.1 each month. Moreover, the top ten percent of students spend \$84 a month more than an average student on private lessons. Also, Table 3 shows that 89.3% of the top ten percent of students attend private lessons, while only 51.2 percent of bottom 20 percent of students can participate in private education. This data clearly show that student achievement is positively correlated to the degree of the expenditure of and participation in private education.

Private education is closely correlated with family income and parents' educational background, but it is related to the regional factor as well. And it seems true that student achievement is significantly influenced by the degree of participation in private education. However, it seems noteworthy that student achievement in the group

Table 3. Expenditure and Participation Percent of Private Education by Achievement Levels in 2007

Achievement Levels	Average Cost of Private Education				Participation Percent on Private Education			
	Elementary	Middle	High	Average	Elementary	Middle	High	Average
Top 10%	312.1	378.8	288.4	322.9	94.4	91.2	67.0	89.3
11~30%	276.6	325.0	272.3	286.3	93.6	87.2	63.1	87.0
31~60%	218.5	252.9	215.2	226.0	87.7	78.4	55.7	77.3
61~80%	166.8	181.9	162.5	171.1	77.6	63.0	47.9	62.3
Bottom 20%	132.4	120.5	135.6	129.1	66.6	46.2	42.8	51.2
Total Average	244.3	251.8	212.0	238.9	88.8	74.6	55.0	77.0

Note: Average cost of private education was represented in US dollars per month. US-Korea annual currency rate in 2007 was 929.2 Korean Won (KRW) per US Dollar (USD) (World Bank, 2008).

persistently taking private education failed to gain any additional improvement than the other group (Statistics Korea, 2008; Park, Sang, & Kang, 2008).

Conclusions

For the last several decades, educational policy in Korea has been concentrated on quantitative success and focused on providing all students with equal opportunities, with equal quality of school systems and teacher quality. With a dramatic development of the Korean economy, however, the deepening disparity of economic wealth leads to the serious education gap in student achievement.

What are the causes of the education gap in Korea? The answer for this question is rooted in a culture emphasizing educational achievement, and being strengthened by the economic growth. Thus, this paper implies that Korean student achievement is significantly influenced by the factors of family SES, such as parents' academic background and income, regional factors, and private education. It is known that the three determinants play the most significant roles in causing the gap in student achievement. However, it seems that school systems, such as school facilities and teacher quality, in Korea do not cause the student achievement gap. For instance, there is little difference in student satisfaction about school systems between students in the urban areas and the rural areas, because the high quality of education in the centralized educational system of Korea, including curriculum, teacher quality, and school facilities, are administered by the government.

During the last decade, the government began to resolve the educational inequality caused by student achievement gap. The policy for narrowing the gap is performed in four ways: After-school programs for reducing parents' costs for private education, supporting programs for students with learning disabilities, gifted education programs, and educational support programs for low-income students. Most of these programs are strongly supported by parents, and some of them have just begun to result in positive outcomes. Furthermore, as the society rapidly becomes multicultural, the biggest concern in the future will be the achievement gap to be caused by cultural differences.

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Mathematical Proficiency and Perseverance in Action: The Case of Maria and Andrew*

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In response to an expanding definition of mathematical proficiency, educators must attend to what mathematically proficient students should *know* as well as what they should *do*. As students are asked to struggle and wrestle with mathematics, educators should expect that students demonstrate perseverance through engagement with difficult mathematics. This has significant implications for seeing one's self as a learner and doer of mathematics, particularly for those with historically limited access to mathematics-related opportunities. A case study analysis of a pair of students in a second grade classroom engaged in algebraic reasoning revealed a striking example of *perseverance in action that supports mathematical learning*. Analysis of classroom discourse across the classroom revealed the social and sociomathematical norms of the classroom that supported such perseverance. Developing mathematically proficient students who persevere has widespread implications as it is those who see themselves as doers of mathematics who have the most access to future educational and economic opportunities.

Keywords: Classroom Discourse, Equity, Mathematical Proficiency, Perseverance.

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The Common Core State Standards for Mathematics (CCSSM) call for the development of *mathematically proficient students, specifying not only what mathematically proficient students are to know*, but also what it is that they are to *do*. This definition of mathematical proficiency extends beyond previous ideas of procedural skill and conceptual understanding to include such notions as having a “productive disposition” towards mathematics as well as developing key mathematical practices, including “[making] sense of problems and [persevering] in solving them” (CCSSM, 2010).

Our work targets the idea that mathematically proficient students are to do mathematics in particular ways and, more

importantly, persevere in doing so. This has significant implications for seeing one's self as a learner and doer of mathematics, particularly for those with historically limited access to mathematics-related opportunities. Whereas educators might agree that perseverance is important for students, it can be an elusive term that reflects long-term goals (i.e. persevering versus dropping out of school). In this paper, on the other hand, we provide a specific example of perseverance using an in-the-moment perspective to examine interactions among students, teachers, and content that reveal *perseverance in action that supports mathematical learning*. Drawing from a close analysis of classroom interaction, our work addresses the following questions: What does perseverance in action look like within the context of a mathematics lesson? What might perseverance afford for student mathematical learning? Finally, what kind of a classroom environment would support students to persevere?

¹ The CCSSM's use of *mathematically proficient* draws from the National Research Council's (NRC) discussion of five intertwined strands of mathematical proficiency: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (NRC, 2001).