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Research Report

What Do Academic Achievement Analyses Say about Primary and Secondary Education?

KDI Focus, No. 30

Provided in Cooperation with:

Korea Development Institute (KDI), Sejong

Suggested Citation: Kim, Hisam (2013) : What Do Academic Achievement Analyses Say about Primary and Secondary Education?, KDI Focus, No. 30, Korea Development Institute (KDI), Seoul, <https://doi.org/10.22740/kdi.focus.e.2013.30>

This Version is available at:

<https://hdl.handle.net/10419/200841>

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KDI FOCUS

November 18, 2013 (No. 30, eng.)

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What Do Academic Achievement Analyses Say about Primary and Secondary Education?

Hisam Kim, Fellow at Korea Development Institute

“High investment in school education does not necessarily lead to higher academic achievement. Therefore, an increase in students’ motivation and other contributory causes is more important than an increase in quantitative input.”

I. Introduction

Although academic achievement is not the only performance indicator for education that aims to promote holistic development of students, it is a key indicator for measuring the outcomes of education that is focused on subjects. This report introduces major findings from a recent comprehensive study that analyzed the characteristics of students, families, and schools in relation to academic achievement in primary and secondary schools (Kim Hisam, 2012) and presents policy implications aimed at improving public education. Analysis of the impact of educational input factors on academic achievement was carried out separately for elementary schools, middle schools, general high schools, and specialized high schools, considering the different stages of education and school characteristics. The study also analyzed the differences in academic achievement between coed schools and single-sex schools and the reasons for

Academic achievement is a key indicator for measuring the outcomes of education.

* This report was prepared based on the main points of *Estimation of Education Production Function Focusing on School Effects and Policy Directions for Primary and Secondary Education* (Kim Hisam, Research Monograph 2012-09, Korea Development Institute, 2012).

* This is the translated version of KDI Focus released on March 25, 2013

those differences, and it makes recommendations for educational improvement with regard to gender segregation and integration.

II. Academic Achievement in Schools and Input Factors for Public Education

The following are the results of an analysis of the factors that influence academic achievement. The analysis was based on data from the first and second waves of Seoul Education Longitudinal Studies, which studied samples of Seoul students in the fourth, seventh (first year of middle school), and tenth grades (first year of high school) in 2010 and followed those same students through the following year.¹⁾ In the analysis model, a range of variables representing characteristics of students, families, and school levels (see Kim Hisam, 2012) are inserted simultaneously as explanatory variables so as to identify the correlation between a particular factor and academic achievement when other factors are similar. This report introduces findings that have direct implications for the improvement of public education.

First, in middle schools and general high schools, the higher the students evaluated the enthusiasm and competence of a teacher, the higher the students scored in the subject (especially in English and math). This can be interpreted to mean that if the teacher evaluations filled out by students for professional development provides effective feedback, it can contribute to improving academic achievement in middle and high schools.²⁾

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There was a clear, positive correlation between favorable class attitudes and subject scores, regardless of school level and grade. While the students' perception of the usefulness of class lessons generally had a positive correlation with Korean and math scores, it showed no meaningful correlation with English scores and even a negative correlation for Grade 4. Elementary school students who receive early English education do not consider basic-level English classes at school useful. School English curricula should consider the fact that private preschool English instruction is especially common.

For elementary school students, neither self-assessed maturity in their study methods nor degree of effort in studying showed positive correlations with test scores, suggesting that the students have not yet to establish good study methods or habits on their own. On the other hand, for middle school and general high school students, the higher the students rated their maturity in their study methods and degree of effort in studying, the higher their academic achievement.

1) The Seoul Education Longitudinal Study, started in 2010 by the Seoul Educational Research and Information Institute, is a tracing study that is scheduled to track sample students every year through the 12th grade. The students' academic achievement is measured by their scores in Korean, English, and math on a test given just before summer vacation, based on materials studied during the first (spring) semester.

2) In a study by Kim Hisam (2009) in which data from the Korean Education Longitudinal Study was used to analyze the influence factors of private education expenses in the 9th grade, it was revealed that the higher students rated teachers' enthusiasm and competence, the lower private education expenses were.

The positive effect of independent study hours on test scores was clearer at higher school levels. In elementary and middle schools, the number of independent study hours had relatively little effect compared to the number of private education hours in increasing English and math scores. Private education had no effect on Korean scores, while independent study hours showed a positive correlation. In general high schools, independent study hours generally showed a very high correlation with test scores. Private education had a positive effect on the scores of Grade 11 students, but the score increase per hour of private education was lower than the score increase per hour of independent study. For students of specialized high schools, hours of independent study had a greater positive impact on test scores than hours of private education.³⁾

When issues arise due to fluctuations in a region's school-aged population—for example, the merger of minischools in agricultural, mountain, and fishing villages or overcrowded classrooms in new towns—it is necessary to consider the correlation between the total number of students and academic achievement to determine the optimal school size. Analysis shows that elementary schools with six or seven classes of thirty students per grade, middle schools with around ten classes of thirty-five students per grade, and high schools with around ten classes of forty students per grade resulted in the highest average academic achievement.

The number of students per teacher is related to class size, and this number is often reduced to increase the quality of education. However, there were only a few cases of a large number of students per teacher corresponding to low academic achievement: Grade 7 Korean, Grade 10 math in general high schools, and Grade 11 Korean in specialized high schools. Results for Grade 5 English and Grade 11 English in general high schools were contrary to expectations. Such results suggest that, contrary to research conducted overseas, reducing the number of students per teacher does not necessarily guarantee improvement of academic achievement. Moreover, the impact of class size reduction on educational performance depends on whether it is an intentional measure to achieve qualitative educational improvement or the inevitable outcome of a decrease in the number of students. In the former situation, the effect will vary depending on whether the classes apply innovative teaching methods appropriate for their reduced size or maintain a conventional lecture format.

The correlation between the percentage of regular teachers, excluding contract teachers and part-time instructors, and the school's average academic achievement was inconsistent. Grade 10 Korean and English scores in general high schools showed a negative correlation with the percentage of regular teachers. Only Grade 10 Korean scores in specialized high schools showed a positive correlation with the percentage of regular teachers. In private schools, a contract teacher has the opportunity to be hired as a regular teacher, a factor that motivates contract

Reducing the number of students per teacher will not necessarily guarantee improvement of academic achievement without innovative teaching methods.

3) Depending on the method of estimation and the subject of study, the per hour score increase due to private education in elementary school is as much as 1.5–2 times that of independent study. This ratio drops to 1.2–1.5 times in middle school and is completely reversed in high school, falling to 0.6–0.8 times. Even in Seoul, with its advanced private education market, the effectiveness of independent study (self-directed learning) increases with grade level, while that of private education decreases.

teachers to strive to excel, unlike in public schools. This phenomenon is corroborated by the comparison of public and private high schools in terms of the correlation between English and math scores and the percentage of regular teachers (the interaction variable, which represents the percentage of regular teachers and the private school dummy variable, is estimated to be negative coefficient).

A positive correlation between teachers' average number of years of experience and academic achievement was found only for Grade 8 English and math, and Grade 11 English in general high schools. The percentage of teachers with master's or higher degrees did not have a positive correlation with academic achievement.⁴⁾

Educational expenditure per student (the total annual expenditure in the settlement of accounts divided by the number of students) showed a positive correlation with the English and math scores of elementary and middle school students. However, test scores of general high school students did not show a statistically meaningful correlation with educational expenditure per student. In fact, Korean and math scores of specialized high school students were rather low for schools with high educational expenditure per student.

A school is designated a "priority school for academic improvement" if its percentage of students who do not meet the basic academic standard on the National Assessment of Educational Achievement (NAEA) is more than double the national average. "Priority schools for academic improvement" showed relatively low average scores overall. This is not a negative effect of the designation, but rather their low scores are the reason for the designation. These schools aim to reduce the percentage of underachieving students by providing remedial education. Analysis has shown that the percentage of students below the basic academic standard has declined approximately 1 percentage point in elementary schools and 2 percentage points in middle schools designated priority schools for academic improvement (Woo Seok-jin and Kim Kyung-hee, 2012). Target schools of the Educational Welfare Special Support Program showed relatively low average scores in English and math. As in the case of priority schools for academic improvement, this result does not imply that the Educational Welfare Special Support Program had a negative effect. Rather, the low scores are a result of the schools' relatively high percentage of disadvantaged students. One of the most important goals of public education is to guarantee a basic level of education to every citizen. Accordingly, to measure the success of the two programs mentioned above, more precise performance analyses—in which the performance indicators are the number of students reaching the minimum standard rather than the students' average academic achievement—will be necessary.

The departmentalized classroom system only had a positive correlation with Korean and math scores in specialized high schools. Because students move to different classrooms designated for specific subjects, this system increases the specialization of classes and allows for level-

4) A study by Kim Hisam (2009) made the observation that a high percentage of teachers with master's or higher degrees corresponded to lower private education expenses.

based instruction. To see whether this system truly has no effect in other school levels and general high schools, an in-depth analysis will be necessary.⁵⁾

Looking at academic achievement in subjects in which students received level-based instruction, Grade 7 Korean and math scores were high, while Grade 10 English and math scores in general high schools and Grade 10 Korean scores in specialized high schools were relatively low. Although further investigation will be necessary to explain this result, it appears to reflect the limitations of level-based instruction in high schools, which are strongly influenced by college entrance exams and a relative evaluation system that forces students to take identical tests regardless of their levels, aptitude, and future plans.⁶⁾

In the case of autonomous schools, which have a certain amount of freedom in the appointment of principals, management of curricula, usage of textbooks, and selection of students, scores in Grade 4 Korean, Grade 5 Korean and math, and Grade 10 math in general high schools were high. In schools with an open principal recruitment system, scores in Grade 8 Korean and Grade 10 Korean in specialized high schools were high.

Level-based instruction has limitations under a relative evaluation system in which the students take identical tests regardless of their levels, aptitude, and future plans.

III. The Impact of Coed Schools on College Scholastic Ability Test (CSAT) Scores

The impact of coed high schools on CSAT scores was analyzed using data from the Korean Education Longitudinal Study (KELS), a tracing survey that has been tracking 6,908 students since 2005, when they were in the seventh grade.⁷⁾ The data provided abundant information about the students during their three years in middle school and three years in high school. In this analysis, the differences between coed and single-sex high schools are observed, sequentially and cumulatively controlling for various factors that can influence academic achievement, as represented by the standardized score for CSAT results in Korean, English, and math. The effects of environmental heterogeneity were eliminated through a fixed effects model for middle schools, wherein a comparison was made among students from the same middle school (around 50 students). Differences in skill levels among students were taken into account by controlling for subject test scores for three years (Kim Hisam, 2012). The following is

5) Kim Hisam (2009) found that the operation of a departmentalized classroom system corresponded to lower private education expenses. Although efforts should be made to link departmentalized classrooms to visible academic achievement, it is important to consider that the various effects of a departmentalized classroom system do not translate only to an increase in test scores. As pointed out in another study by Kim Hisam, et al. (2010), utilization rates of departmentalized classrooms (e.g. English immersion classrooms in elementary schools and English-only classrooms in middle schools) vary with the capability of teachers. Therefore, physical infrastructure alone is insufficient without adequate teacher training, the effort of teachers, and a sufficient budget and workforce for the management and maintenance of departmentalized classrooms.

6) According to the study by Kim et al. (2010), the results of a survey on level-based English instruction revealed lower-than-expected ratings by students who received level-based instruction. Ratings by students, parents, and teachers were all lower for level-based instruction in high school than in middle school.

7) The Korean Education Longitudinal Study, conducted by the Korea Educational Development Institute, began tracking students in 2005, when they were in the seventh grade, and plans to track them yearly until 2023, when the students reach age thirty. The data from the sixth year provides the students' actual scores on the 2011 CSAT, making available highly reliable information on academic achievement.

a summary of important findings from the analysis.

First, the negative impact of coed schools was clear on CSAT scores in all three subjects: Korean English, and math. The negative impact of coed schools was found to be quite significant even in the case of standardized high schools—which are randomly assigned to students living in the school district—giving them little choice on the schools they attend.

Second, the negative impact of coed schools on CSAT scores was greater on female students than on male students. This result is contrary to the general belief that female students have an advantage over male students in class ranking in coed schools, but agrees with research findings showing that female students have much to gain in terms of academic achievement by attending all girls' high schools.

Third, the difference between CSAT scores in coed and single-sex schools was attributed in part to factors that arise before students enter high school. Notably, when family background information, such as parents' education level, and students' academic achievement in middle school were controlled for by subject, the difference between CSAT scores in coed schools and single-sex schools was reduced by 40% in Korean and English, and by 30% in math. This suggests that students with high academic achievement preferred single-sex schools and tried to avoid coed schools, but also shows the possibility that the factors that arose during high school affected the scores.

Fourth, assuming the above to be true, the factors that arose during high school were compared between coed and single-sex schools. Hours of independent study had been found to have a greater impact on increasing CSAT scores than hours of private education (Kim Hisam, 2010). Coed school students reported fewer hours of independent study than single-sex school students. The fewer independent study hours of coed school students contributed to their lower test scores.

Next, when the number of study hours was controlled for, and students with comparable study hours were compared, some of the significant remaining differences were found to stem from the students' recreational activities and conduct. Specifically, analysis revealed that coed school students spend more time than single-sex school students on talking on cell phones and sending text messages, chatting online using instant messengers, and managing personal homepages and blogs. These activities, which are presumed to be partially related to associating with the other gender, were found to have an adverse effect on academic achievement.

Finally, using a quantile regression analysis model, it was estimated that the negative impact of coed schools on Korean and English scores was more significant for low- to mid-level students and female students. The negative impact of coed schools on math scores was high for mid- to high-level students, while there was no appreciable difference between the genders.

The above findings confirm the negative impact coed schools have on CSAT scores. The differences between test results of coed schools and single-sex schools were attributed largely to differences in various factors that arose before the students entered high school, but they also seemed to stem from the students' loss of study hours and lack of learning flow while

attending high school. Nevertheless, before making a final judgment on the educational impact of coed schools, the following points should be considered as a measure of precaution.

First, the findings of this study are specifically on the effects of coed schools on CSAT scores in Korean, English, and math. Therefore, they should not become the basis of a generalization that coed schools have the same effect on all measures of academic achievement. Coed schools' impact on academic achievement varies at different stages of education. For example, at the middle school level, when girls mature relatively fast compared to boys, girls in coed schools tend to dominate boys in studying as well as in school activities, and they show higher academic achievement than girls in single-sex schools. At the high school level, the opposite phenomenon becomes prominent, and the negative impact of coed schools on female students becomes significant (Meighan, 1981).

Holistic development, or the pursuit of the ideals of humankind, is the purpose of education. Therefore, evaluating the educational impact of coed schools only in terms of academic achievement would be biased and incomplete. Coed schools were introduced in Korea in order to help male and female students develop mutual understanding, cooperative values, and equal roles rather than to increase academic achievement. Therefore, the success of coed schools in reaching their original goals should be seriously considered before policy decisions on coed schools are made.⁸⁾

IV. Conclusion

From the abovementioned findings of the academic achievement analysis, the following policy implications can be drawn.

First, teacher evaluations (currently Teacher Evaluation for Professional Development) must be improved by giving primary importance to evaluation by students. It should be noted that English and math scores of middle and high school students have a positive correlation with the enthusiasm and competence of teachers as evaluated by students. What is more, private education expenses go down when students rate school teachers' enthusiasm and competence highly. Considering these facts, school teachers might be the key to killing two birds with one stone: raising academic achievement and lowering private education expenses. Teachers should be encouraged to concentrate more on teaching and less on administrative tasks. Rather than top-down evaluation by school boards, bottom-up evaluation by students and evaluation by colleagues should be emphasized so that individual teachers can receive feedback that can serve as the basis for improving their classes.

The negative impact of coed schools partly stems from the students' loss of study hours and lack of learning flow while attending high school.

8) A study by Kim Jae-cheol (2008) analyzed the impact of coed schools on gender equality awareness, as well as on academic achievement. This study found that coed schools did not have a greater positive impact on gender equality consciousness, suggesting the real possibility that coed schools have not been successful in fulfilling their original goals.

Teachers and parents should make every effort to help students develop the capacity for self-directed learning, which is more effective than private education at increasing scores with each increasing grade level.

Second, teachers and parents should make every effort to help students develop the capacity for self-directed learning. Analysis results show that even in Seoul, where the conditions of private education are superior, the impact of private education hours decreases with increasing grade level, while the impact of independent study hours increases. At the high school level, the score increase per hour of private education was found to be about half that of independent study. The problem is that the habits and skills of studying independently are not attained overnight, and dependence on private education from an early age can seriously hurt students' ability to cultivate the capacity for self-directed learning. Therefore, in order for students to develop self-directed habits for studying in school, teachers should give assignments and feedback that motivate students to study actively. In addition, evaluation systems should be improved upon so as to discourage private education that only helps students move up in class ranking by preparing them for school exams. Parents must refrain from giving in to their competitive anxiety and subjecting their children to excessive private education, which robs students of opportunities to cultivate the capacity for self-directed learning.

Third, high investment in school education does not necessarily lead to higher academic achievement. Therefore, an increase in students' motivation and other contributory causes is more important than an increase in quantitative input. Analysis results showed no clear evidence that a low number of students per teacher leads to high academic achievement. A positive correlation between educational expenditure per student and academic achievement was found in elementary and middle schools, but not in high schools. In addition, external factors such as the percentage of regular teachers, the average number of years of teaching experience, and the percentage of teachers with master's or higher degrees did not show consistent correlations with academic achievement. These results imply that reducing class size, increasing expenditures, and raising formal teacher qualifications will not automatically increase students' academic achievement. In a classroom with fewer students, appropriate teaching methods and student participation is necessary, and the effectiveness of increased expenditures lies in where it is applied. Also, teachers' effort could be more important than their qualifications. Therefore, the administration and finances of a school should be concentrated on students, and an in-depth investigation should be conducted to find ways to elicit from teachers both effort and the innovation of better teaching methods.

Fourth, the government and the Office of Education must make a concerted effort to accurately evaluate the progress of various education policy projects and analyze the factors in their successes and failures so as to eliminate ineffectual policy projects and increase the number of successful cases. Priority schools for academic improvement have the clear goal of reducing the number of students below the basic academic standard as well as clear performance indicators. Such policies—rather than focusing on superficial results, such as increasing the number of students that enter top-ranking schools—must continue, for they require schools to guarantee a basic level of education to all students. Considering the current status of and possible increase in maladjusted or at-risk students, the Educational Welfare

Special Support Program should be supplemented and expanded. The correlation between the departmentalized classroom system and academic achievement was uncertain, and further in-depth empirical analysis is necessary. Laying out the physical infrastructure of departmentalized classrooms is insufficient; policies must reflect the need to support the system's operation and teachers' skills. Some positive effects of level-based instruction were found in middle schools, but not in high schools, which are strongly influenced by standardized college entrance exams. This suggests the limitations of an approach that seeks partial improvement when the larger system has not been changed. Both autonomous schools and schools with an open principal recruitment system had some positive impact on students' academic achievement. This suggests the potential for further improvement in academic performance, based on the management of autonomous schools and the philosophies and endeavors of principals appointed through open recruitment.

Evidence-based educational policies, which are informed by empirical analysis results, are expected to gradually take root in the US as well as in Korea.⁹⁾ Among education policy projects in which the government and the Office of Education invests, in-depth evaluation should be performed on those with questionable efficacy in order to determine their continuation and seek improvement measures. Newly planned projects should not be tested out on the assumption that they will be implemented. Instead, they should undergo a pilot phase, in which each project's validity is evaluated based on experimental or quasi-experimental pre-application designs.

Finally, the current status of coed schools must be examined in order to seek directions for improvement. Coed schools have been expanded at the policy level based on educational philosophies that promote cultivation of gender equality awareness and sociality. Analysis results showed that coed high schools have a clearly negative effect on CSAT scores in all major subjects, and that this effect is greater on female students than male students. The low CSAT scores of coed school students were largely attributed to the fact that they studied for fewer hours than single-sex school students and spent more time talking on cell phones and sending text messages, chatting online using instant messengers, and managing personal homepages and blogs. For more accurate information on the current status of coed schools compared to single-sex schools, qualitative research, including surveys, observations, and interviews, will be necessary. Some important topics of future research will include the difference between male and female students with regard to the impact of the recent increase of using social media and online chatting on smartphones on their academic endeavors and whether this impact is escalated by the possibility of associating with the opposite sex in coed schools. Moreover,

9) The Education Sciences Reform Act was passed by the US Congress in 2002, requiring all educational research funded by the federal government to use strictly experimental (i.e. random selection of targets) or quasi-experimental (i.e. selection of adequate comparison groups) research designs. About data driven decision making (DDDM), there is a voice of caution that the acceptance of quantitative data in policies, without consideration of qualitative research results, can lead to biased evaluation and judgment of complicated social phenomena based on mere numbers (Washington Post, Nov. 21, 2012).

In order for coed schools to achieve their educational potential, they must first establish a gender-sensitive educational environment, accompanied by sophisticated management.

in order for coed schools to achieve their educational potential, they must first establish a gender-sensitive educational environment, accompanied by sophisticated management. For example, coed schools should encourage students to understand and learn from the admirable characteristics of the opposite gender rather than instigate gender segregation, and classes should be designed with consideration to the delicate differences between the genders as related to the nature of specific subjects.

As described above, policy directions for improvement of primary and secondary education were drawn from analyses of academic achievement. After recent comprehensive educational reforms in Korea, people are paying attention to specific changes in schools and the effects of individual policies. In order to form a basis of judgment on specific directions for improving public education, much empirical research must be accumulated in the years to come. Considering the current trend of increased autonomy and diversity among schools, it is this researcher's hope that scholars and policy researchers will be able to make a practical contribution to the reduction of errors in specific educational experiments by individual schools by identifying specific factors that lead to superior education.

Nevertheless, an approach centering on academic achievement is accompanied by the risk of overlooking other important educational values. Thus, it will be necessary to include performance indicators other than academic achievement, such as student satisfaction rates, personality, and health, as well as non-cognitive educational performance in future analyses. ■

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