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Student achievement and social stratification: A case of primary education in Kenya

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Abstract

After enrollment in primary education in Kenya rapidly increased, there was a need to investigate how to improve the quality of education in Kenya. Inequity in primary education causes inequity throughout life. The purpose of this study is to examine the most influential factors that improve the learning conditions in primary schools in Kenya. Two research questions were set up for achieving this : (1) Which factors have more influence on student achievement, school factors or family factors? (2) What kind of factors determine higher achieving schools? The Hierarchal Linear Model (HLM) was applied for the achievement analysis. The data used here came from SACMEQ Ⅱ , an international learning assessment. The first research question examined the effect of SES on the achievement. The family background factor significantly affected reading scores, though single predictors were insignificant in explaining effects on student achievement. The second research question looked at the factors causing between-school variation in Kenya. There was a positive relationship between the aggregated socioeconomic status and the aggregated student achievement. School policy and other learning process factors might be potential issues for further study. A combination effect is also another area that can be further explored. It might be helpful to control the combination effect for estimating the pure relationship between academic achievement and family and school factors.

1. Introduction

"Quality education for all"- this is the slogan for developing countries which are implementing Universal Primary Education (UPE) policy. The statement is also one of the national strategies of Kenyan government. After Free Primary Education (FPE) policy was implemented in Kenya, enrollment in primary education rapidly increased. Indeed, because of the FPE policy, marginalized children could go to schools. They do not have to pay for their tuition, and can receive free textbooks, pencils, and exercise books from the government. Therefore, Education For All (EFA) seemed to ensure access to school for marginalized children.

However, the FPE policy did not only have a positive impact, but it also had a negative impact on primary education in Kenya (Swamura & Sifuna 2008). The rapid increase of students in primary schools resulted in overcrowding, with more than 60 pupils in a single classroom. In addition, while tuition for primary school is free, extra costs such as uniforms, bags, and lunches are not free. The extra costs limit poor children from being able to attend school. There is a need to investigate how to improve quality of education in Kenya.

The purpose of this study is to examine the factors that are the most important to improve the learning condition in primary schools in Kenya. Two research questions are set up for achieving the purpose of this study: (1) Which factors have more influence on student achievement, school factors or family factors? (2) What kind of factors determine higher achieving schools?

This study uses the international learning assessment, Southern and Eastern Consortium for Monitoring Education Quality (SACMEQ). Fifteen countries and regions are currently part of the project. The assessment includes both school factors and family factors with English and Mathematics test scores. In Kenya, grade six pupils are assessed. School factors indicate school resources (blackboards, duplicators, chairs, etc.), school location, and pupil-teacher ratio. Family factors include parent's education, possessions at home (car, radio, telephone, electricity, newspaper, etc.), and frequency of using English at home. SACMEQ has individual characteristic factors such as gender, and age in months as well. Therefore, this study examines the pure relationship between student achievement and some factors considering situations outside schools.

2. Literature Review

2. 1. Educational context in Kenya

Kenya is about 582,646 km^2 and its population is around 38.5 million. More than 40 indigenous ethnic groups are in the country. There are two official languages: Kiswahili and English. Kiswahili and local languages are used for instruction in the lower grades of primary school. Instruction language shifts to English from medium grade levels. English and Mathematics, both assessed subjects, are taught in English.

The education system in Kenya is composed of eight years of primary, four years of secondary, and four years of university education. Recently, nursery school has become popular in Kenya, which children can attend at around three years old. The official age for primary schooling is six years old. However, over-aged children continue to enroll in primary schools, and it is not uncommon for 10 years-old or 12 years-old pupils to be in grade one.

Most young people in Kenya do not attend at university level for several reasons, including few universities, a lack of financial resources on the student side, and a mismatch of supply and demand in employment. After secondary school many students go to technical college, which the government subsidizes. Therefore, the education system in Kenya has put an effort into vocational education (Bagaka's 2010).

Another characteristic of Kenya's education is a highly centralized administrative system. The Minister of Education is the top of the system and the Ministry of Education plays the central role in the education system. The regional level and the district level directors head each level office. The management service of the directorate of education indicates the administration, supervision, and inspection of educational programs, development and

implementation of various curricula, and development and production of programmed materials, in a collaborative manner with certain institutions and departments of the Ministry.

Although the majority of Kenyan pupils are currently enrolling primary school, there is still a problem with students dropping out before 8th grade. Out of the majority of students who do finish 8th grade, most of them do not continue to secondary school due to a lack of academic ability, a lack of financial resources, or the inability to fit in to school culture.

The Kenya Certificate of Primary Education (KCPE) national examinations are highly competitive so that schools are like a training hall for the national exam. Based on the performance, students are selected for secondary education. Most of primary schools have extra coaching sessions for pupils in the early morning, lunch time, afterschool, and even on weekends and holidays (Sawamura & Sifuna 2009).

According to Sawamura and Sifuna (2008), the transition rate from primary to secondary education was 43.8% on average from 2003 to 2006. Less than half pupils are admitted by secondary schools in Kenya. In addition, at the end of secondary school, students must take the national Kenya Certificate of Secondary Education (KCSE) examinations to be admitted to higher education. For example, Bagaka's (2010) mentions that only 11% of all students who take the KCSE examination or 37% of those who qualify for university, gain admission to higher education.

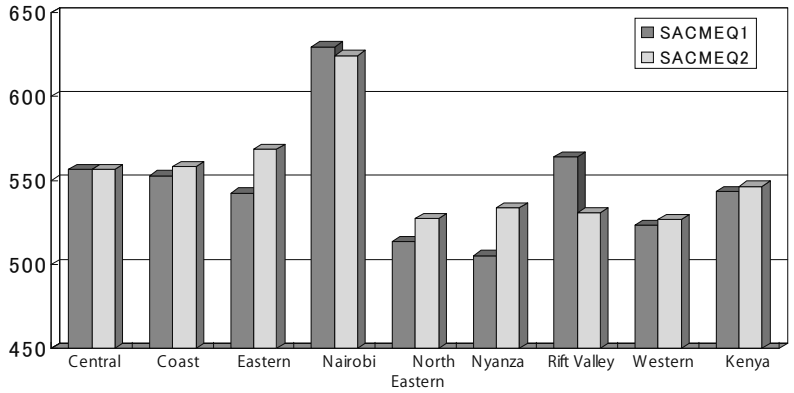
Kenya varies considerably from one region to another in terms of educational situation. The country is divided into eight provinces: Central, Coast, Eastern, Nairobi, North Eastern, Nyanza, Rift Valley, and Western. Each province has an administrative director of education. They are responsible for all educational activities in the province (Hungi & Thuku 2010). Unique characteristics of these provinces demonstrate the diversity of Kenyan society and attitudes toward education. While the least developed area is North Eastern province, which is mainly arid, and its inhabitants are mostly nomads, the most developed province is Nairobi, which is entirely urban and its population is about five million. Slum areas, however, are different from the city center and the outskirts of Nairobi. The majority of population in Coast province is Muslim. The most diverse province is Eastern in terms of geography, economic status, and culture. One main ethnic group dominates Western province. The main cash crop in this province is sugar cane, and widespread child labor is practiced. Nyanza province is suffering from high percentage of orphans of HIV/AIDS. Central is a densely populated area, though cash crops such as tea, coffee are endowed by high rainfall throughout the year (SACMEQ 2010).

Figure 1 indicates provincial average performance of English in SACMEQ Ⅰ, Ⅱ. There are achievement gaps among the provinces. Nairobi showed the highest performance among all, and North Eastern the lowest. Central, Coast, and Eastern are above or close to the national average. Nyanza, Rift Valley, and Western are below the national average, except for Rift Valley in SACMEQ Ⅰ.

Figure 2 is the proportion of SES levels of primary schools in Kenya. The high SES level

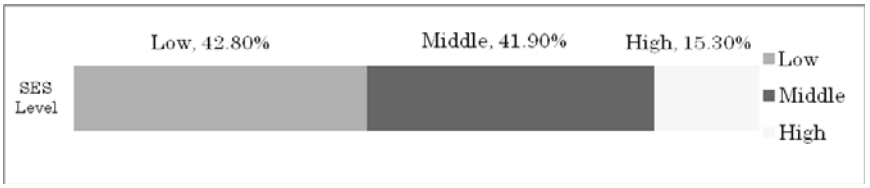
is 15.3%, the middle SES level is 41.9%, and the low SES level is 42.8%. This SES (Socio-Economic Status) is composed of parent's educational qualification, home materials and possessions at home. The SES variable ranges from 1 to 15 levels. The low SES means from level-1 to level-5. The middle SES means from level 6 to level-10. The high SES means from level-11 to level-15. Figure 2 explains that majority of pupils in Kenya have parents who are low education level and possessions at home.[1]

Figure 1: Provincial average performance of English in SACMEQ I , II



Source: Created by the author based on SACMEQ I and II

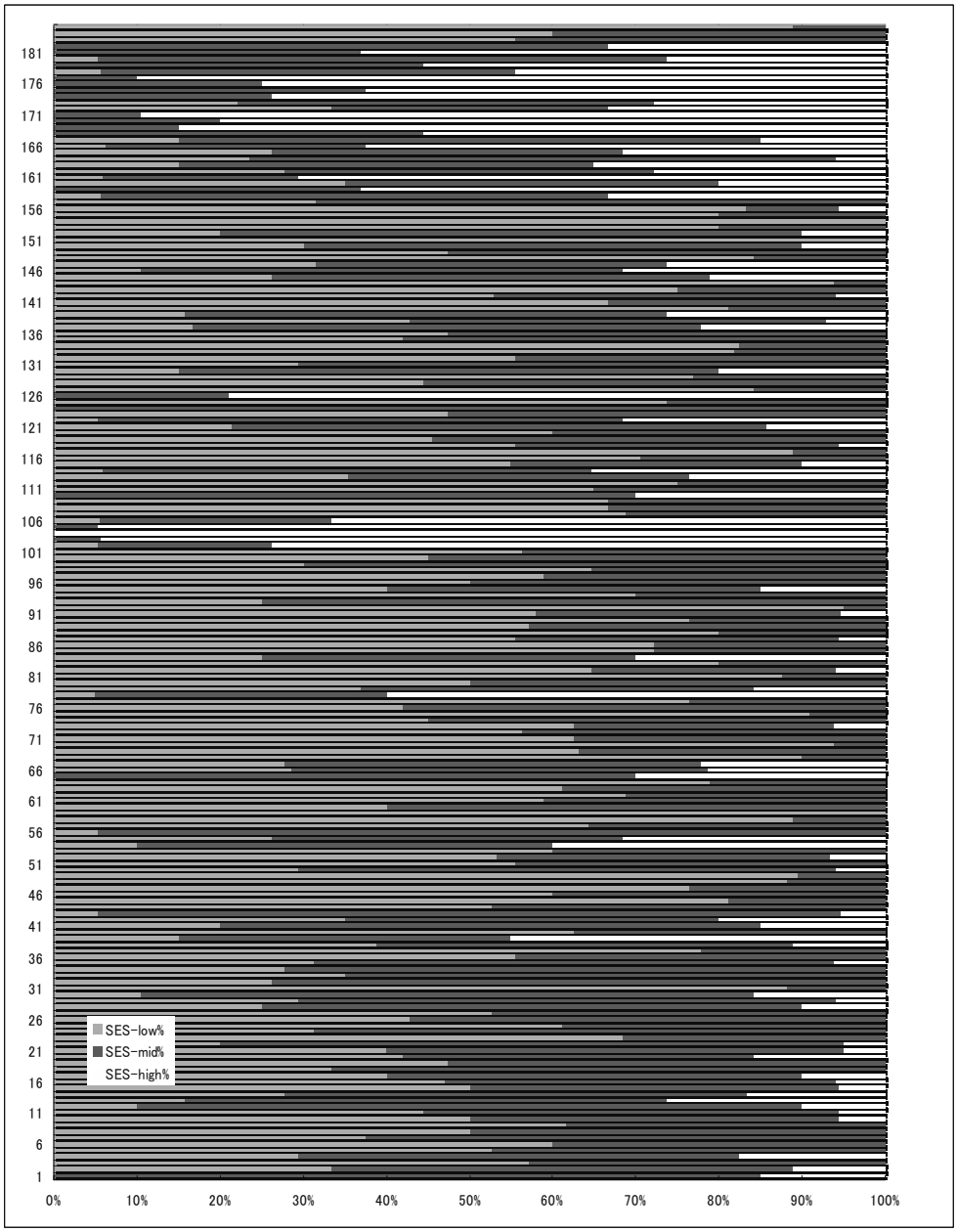
Figure 2: Proportion of high, middle, and low SES level at national level in Kenya



Source: Created by the author

Figure 3 is the proportion of SES level at the school level in Kenya. Some schools have only pupils from the high SES level. Others have only pupils from middle or low SES levels. Compared to the national proportion in Figure 2, this school SES level varies among schools.

Figure 3: The proportion of SES level at the school level



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2. 2. Social stratification and primary education in Kenya

(1) School divide in primary school in Kenya

The school divide in primary school in Kenya became a problem when test scores revealed an inequality of educational opportunity. It is said that the school system normally functions

to rectify socio-economic inequality ensuring learning opportunity for all children. However, whether children can go to good school seems to be determined by family background, and economical factors in Kenya.

Sawamura (2006) argues school divide mechanism in Kenya comes from two aspects of disparity. First, he mentions provincial disparity based on geographical, cultural, and economical varieties. For example, the least average scores and enrollment ratio in North Eastern province stems from nomadic culture. Daily language use of English and Kiswahili has an influence on the difference between these reading scores.

The second aspect is the public-private or boarding school divide. Top schools in terms of KCPE performance are basically private schools. The private schools occupied 90 percent of the top 200 in school rankings. The other high-performing schools are boarding schools. These boarding schools are well equipped, accessible, and gender-balanced. Parents are asked to pay relatively higher tuitions. Rich pupils have an advantage of access to better facilitated schools, because both the private schools and the boarding schools are expensive.

(2) Theoretical framework of social stratification and education

The study on social stratification and education in developing countries has attracted attention for very different social conditions in contrast to more industrialized societies (Buchmann & Hunnum 2001). Researchers in this field have had an interest in extending theoretical perspectives from industrialized countries. Buchmann and Hunnum (2001) mention four broad areas regarding education and social stratification: (a) macro-structural forces shaping educational stratification, (b) the impact of family background on educational attainment and achievement, (c) school factors as they relate to educational outcomes, and (d) the impact of education on social mobility in developing regions.

National conditions, state policies, and global forces make the unique macro structure of educational stratification in a country. The highly centralized education system has an influence on the educational polices. In addition, global forces that international agencies created have also influenced the education system in Kenya. For instance, the structural adjustment policies (SAPs), which facilitate debt servicing through fiscal austerity and reduced government intervention in indebted nations, have been traced to declines in educational spending (King 2007; Buchmann & Hannum 2001; Onwami & Onwami 2010). Besides, historically, a particular ethnic group had some connections with Europeans before independence. These historical, structural forces created the inequity of social structure and the unbalanced education system in Kenya.

Categories (b), and (c) are about the impact of family background and school factors on educational achievement. Coleman Report (Coleman et al. 1966) is one of the most famous studies in developed countries regarding these categories. Their findings indicate that school factors had little effect on academic achievement after taking into account family background factors. One of the achievements of the research has set off a lively debate about the relative

effects of school and family factors (Hungi & Thuku 2010).

The debate was primarily within developed countries until Heyneman (1976) conducted research in developing countries. What he found was that family background is less important than school factors in determining academic achievement in Uganda. Besides, in his next work, Heyneman and Loxley (1983) compared the impact of school and family factors on student achievement in developing and developed countries. They concluded that "the poorer the country, the greater the impact of school and teacher quality on achievement" (p.1180). This conclusion is usually referred to as the "Heyneman-Loxley effect" in educational studies and the finding has been used to justify the importance of school inputs for educational development in developing countries.[2]

Finally, regarding the fourth category, studies on the effects of education on social mobility in developing regions have been dominated by single country studies. Although these studies have been facing data constraints, these studies in developing countries have focused on how industrialization enhances intergenerational occupational mobility in a society (Buchmann & Hannum 2001). Some researchers supported the industrialism thesis, which states that industrialization leads to greater social openness and promotes social mobility as societies develop. A few studies tested the industrialism thesis during 1970s, and 1980s, to find evidence to support the industrialism thesis (Buchmann & Hannum 2001). However, even after one of the research for testing the thesis by Treiman and Yip (1989), which was cross-national data analysis including developing countries, they could not prove the impact of industrialization on social mobility.

This is consistent with the critical study of the Heyneman-Loxley effect by Baker et al. (2002). They reassessed the HL effect using 1990s TIMSS data and concluded that the impact of family background on academic achievement was similar among nations regardless of national income. It suggests that the no HL effect was because of the widespread mass schooling. Although the social mobility process is yet-to-be defined, it is clear that the industrialization level does not enhance social mobility in a society. Therefore, it would appear that expansion of formal schooling through economic development cannot cancel out the reproduction of social inequity by schooling.

3. Methodology

3.1. Analytical framework

The Hierarchal Linear Model (HLM) introduced by Raudenbush and Bryk (2002) is an advanced version of multi linear regression. The HLM allows variance in outcome variables to be analyzed at multiple hierarchical levels, whereas in multiple linear regressions all effects are modeled at a single level. Thus, HLM is appropriate for use with nested data.

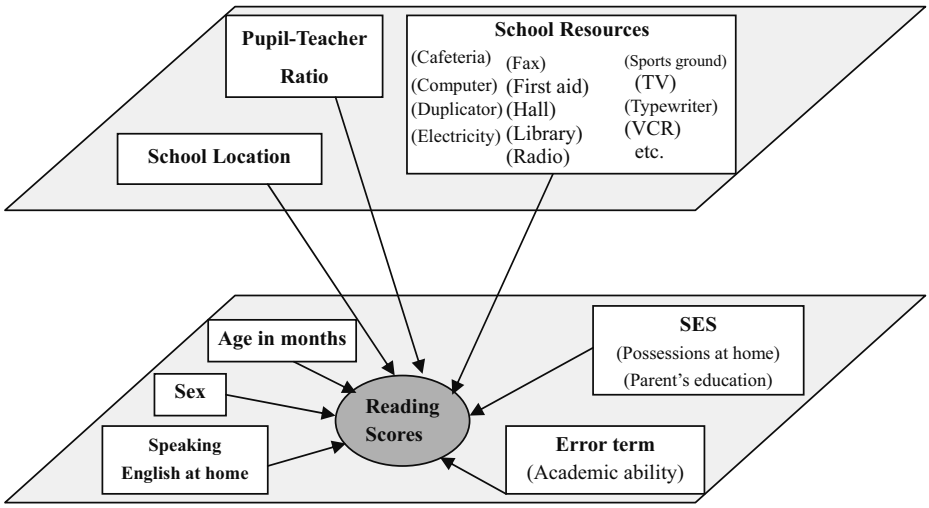
Onsume et al. (2005) built a conceptual framework for HLM in the context of primary education in Kenya. In his study, a three-level hierarchal model was built: province level,

school level, and student level. However, the three-level model did not fit well. The province level could only explain 8% of the variance, though the school level explained 25%, and student level did 10%. In addition, Hungi and Thuku (2010) also applied a three-level hierarchal model: school level, class level, and student level. While the school level explained 27% of the variance, the class level only 2% and the student level 12%. From the results, both the student level and the school level worked, but the province level, and class level did not. Therefore, this analysis applies a two-level model and uses core variables to build a simple and fundamental analytical framework.

The hierarchal structure, which influences student achievement, is in Figure 4. Reading scores, which is dependent variable of the analysis, is the center at the student level layer. Sex and age in months are control variables. Possessions at home and parent's education compose socio-economic status (SES). Since each pupil has different learning abilities, the error term is regarded as a proxy of student ability.[3]

Three school factors are on the school level. Several resources compose the school equipment factor, called the school resource variable. The pupil-teacher ratio is used to control quality of learning in a classroom. School location is a categorical variable. It has three categories: large city, small town, and rural area.

Figure 4: Conceptual framework of the multilevel model



Source: Created by the author based on Onsume (2005)

3. 2. Data and model

(1) Hierarchal linear modeling

English score is the dependent variable. Independent variables consist of total seven variables. Sex, age in months, socio-economic status, and speaking English at home are from the student

level. School resources, pupil-teacher ratio, and school location are from the school level. The intercept, β_{0ij} in the student-level equation [1], is the dependent variable of the school level equation [2]. Variables (except for sex and speaking English at home) are entered into the equation centered about their group mean, so that the size of coefficients can be compared across predictors (Backer et al. 2002). The following equations are empirical models of this study:

$$Y_{ij} = \beta_{0ij} + \beta_{1ij}X_{1ij} + \beta_{2ij}X_{2ij} + \beta_{3ij}X_{3ij} + \beta_{4ij}X_{4ij} + r_{ij}. \quad (i = 1, 2, 3 \ldots) (j = 1, 2, 3 \ldots) \qquad [1]$$

$$\beta_{0ij} = \gamma_{00} + \gamma_{01}W_{1j} + \gamma_{02}W_{2j} + \gamma_{03}W_{3j} + \mu_{0j}. \quad (j = 1, 2, 3 \ldots) \qquad [2]$$

Where,
Y_{ij}: Reading score of i^{th} student in j^{th} school;
X_{1ij}: Age in months of i^{th} student in j^{th} school;
X_{2ij}: Sex of i^{th} student in j^{th} school;
X_{3ij}: Socio-economic status of i^{th} student in j^{th} school;
X_{4ij}: Frequency of English use at home of i^{th} student in j^{th} school;
r_{ij}: Error term of the model (Academic ability of i^{th} student in j^{th} school);
β_{0ij} : Mean score of reading tests of pupils (Intercept of student-level);
γ_{00} : Mean score of reading tests of schools (Intercept of school-level);
W_{1j}: School resources of j^{th} school;
W_{2j}: School location of j^{th} school;
W_{3j}: Pupil-teacher ratio of j^{th} school;
μ_{0j}: Residual of j^{th} school (By assumption, $E(\mu_{0j}) = 0$ and $Var(\mu_{0j}) = s^2$).

All school level variables are centered in the model. This analysis presumes that other coefficients at student level are constant:

$$\beta_{qij} = \gamma_{qsj} + \mu_{qj}.(q=1,2,3,4) \text{ (By assumption, } E(\mu_{qj}) = 0 \text{ and } Var(\mu_{qj}) = t_{qj}.) \qquad [3]$$

Where q is an index of the four student-level variables, and μ_{qj} is the school level residual (eq. [3]). Given school-level coefficients function in the same manner of equation [2], the assumption would mean that some school factors have some impacts on effects of student-level factors on achievement, the gradients of independent variables at student level (β_{qij}). However, the assumption is not relevant for this study. Therefore, this study applies the equation [3] for student-level coefficients.

(2) Data

The data used here comes from SACMEQ Ⅱ. It focuses on student scores in mathematics and

reading tests at the Grade 6 level. The survey collected information from pupils, teachers, school principals, and parents. The SACMEQ Ⅱ project used basically the same methodology for test, and questionnaire construction and scaling as other international learning assessments such as Trends in International Mathematics and Science Study (TIMSS), and Programme for International Student Assessment (PISA) (Hungi & Thuku 2010).

Table 1 shows the variable lists used for this analysis. The performance of pupils in Kenya is basically high among other SACMEQ countries. Looking at Mean SES in Kenya, it is 6.40 and it means that most of the pupils are from the lower SES level. The English dummy variable indicates that most of pupils in Kenya speak English at home. Age in months is 167.31, almost 14 years old, however, the age for a Grade 6 pupil in Kenya is officially 12 years. It means that there are many over-aged pupils. The school resources variable is 7.99. It indicates that most of schools are not well equipped. The mean of pupil-teacher ratio is 34.22. The largest class has 67 students, while the smallest class has only thirteen students. In terms of school location, most schools are in rural areas and small towns.

Table 1: Variable lists for the model[4]

Variables	N	Mean	SD.	Min.	Max.	Description
Dependent Variables						
Reading Scores (ZRALOCP)	3299	553.39	93.37	254.37	947.10	English score
Independent Variables						
Student Level						
Sex (ZPSEX)	3299	0.49	0.50	0.00	1.00	Sex (1 = female, 0 = male)
SES (ZPSES)	3299	6.40	2.79	1.00	15.00	Socio-economic status (Parent's total education and possessions at home)
English (ZPENGLIS)	3299	0.88	0.33	0.00	1.00	Speaking English at home (1 = yes, 0 = no)
Age in Months (ZPAGEMON)	3299	167.31	19.04	128.00	250.00	Pupils Age in Months
School Level						
Resources (ZSRTOT22)	185	7.99	3.48	1.00	20.00	School equipments
PTR (ZSPTRATI)	185	34.22	9.37	13.11	67.43	Pupil-Teacher Ratio
Location (ZSLOCATI)	185	0.70	0.85	0.00	2.00	School Location (2 = large city, 1 = small city/ town, 0 = rural)

Source: Created by the author

4. Results

Table 2 shows the results of the Hierarchal Linear Model. The Null model that has no independent variables is the baseline of the analysis. Intraclass correlation (ICC) tells us the strength of the effect of group. Akaike Information Criterion (AIC) is the indicator of model fit. Lower AIC indicates a better model.

Model 1 is an extended model of the null model. SES is added in the null model. The

slope of SES is constant, and it presumes that the effect of socioeconomic status does not vary among schools. Model 2 assumes another type of the extended null model. Resource is added in the school level of the extended null model. Model 3 and Model 4 are called and Coefficient-as-Outcome Model (COM). Although the null model and the Intercept-as-Outcome Model (IOM) presume that the random effect is only in the intercept at the student level; the COMs, Model 3 and Model 4 set random effects on the slope as well. Model 3 includes two variables, SES and Resources. Model 4 added more three variables, Sex and Age in months, and English at the student level. Model 5, the final model uses all variables.

4. 1. Pupil-level factors

All the variables show statistical significance on achievement. Especially, SES is constantly statistically significant and positive. Therefore, if students have higher SES, their performance will be higher than students with lower SES. However, its effect is not much stronger over than other variables. In Model 1 and Model 3, when it is at the student level solely, the effect of SES is 6.72, and 6.66, respectively. Age in months is -0.86 and Sex is -0.81 in Model 4. Both are statistically significant and negative.

From these results, it would appear that older girls tend to show lower performance. English has the strongest effect on achievement. It is 18.88, and is much bigger than SES. The standardized models in Table 3 show the relative strengths of the variables among them. Again, the strongest effect is English, 0.20 the same as the non-standardized model. Both Age in month and Sex are negative, respectively, -0.08, -0.01. Then, the SES variable is 0.06. The effect of SES is stronger than Sex, and Age in months, but it was weaker than English.

4. 2. School-level factors

Resource is basically statistically significant and positive in these multilevel models. It means that students going to well-equipped schools tend to get higher scores of English. From Model 2 to Model 4, Resources constantly shows around 9.00. Pupil-teacher ratio is negative, -2.17. It means that students in a smaller size classroom perform better. Location is not statistically significant.

As can be seen in the standardized models in Table 3, the relatively stronger school factor is Resources, 0.09, positive. However, the effect of Resources is still smaller than English as the proxy of the family culture variable. Finally, Location is also not statistically significant. On the other hand, the Pupil-teacher ratio is negative, -0.02, and it is statistically significant. Although its effect is not strong, the pupils in smaller size classrooms perform better.

Table 2: Result of hierarchal linear model

	Null Model			Model 1			Model 2			Model 3			Model 4			Model 5		
Variables	**Coefficient**		**SD**	**Coefficient**		**SD**	**Coefficient**		**SD**	**Coefficient**		**SD**	**Coefficient**		**SD**	**Coefficient**		**SD**
Age in months													-0.86	***	0.08	-0.86	***	0.08
Sex													-0.81	***	3.02	-8.04	***	3.03
SES				6.72	***	0.68				6.66	***	0.68	5.25	***	0.69	5.25	***	0.69
English													18.99	***	4.40	19.18	***	4.41
Intercept	550.16	***	4.82	550.15	***	4.82	475.77	***	11.54	478.55	***	11.63	454.48	***	14.68	521.52	***	25.63
Resource							9.47	***	1.31	9.11	***	1.33	9.09	***	1.32	8.14	***	1.28
PTR																-2.17	***	0.42
Location																7.55	**	3.62
Within-School Variation	57.07%			56.19%			64.59%			63.65%			49.77%			49.64%		
Between-School Variation	42.93%	***		43.81%	***		35.41%	***		36.35%	***		50.23%	***		50.36%	***	
AIC	35232			35131			35175			35082			34916			34846		
ICC	0.43			0.44			0.35			0.36			0.50			0.50		

Note: * p<0.1, ** p<0.05, *** p<0.01
Source: Created by the author

Table 3: Results of the hierarchal linear model standardized

	Null Model			Final Model		
Variables	**Coefficient**		**SE**	**Coefficient**		**SE**
Age in months				-0.01	***	0.00
Sex				-0.08	***	0.03
SES				0.06	***	0.01
English				0.20	***	0.05
Intercept	-0.02		0.05	-0.02		0.10
Resource				0.09	***	0.02
PTR				-0.02	***	0.00
Location				0.04		0.07
Within-school variation	57.06%			48.68%		0.70
Between-school variation	42.93%	***	0.67	63.61%	***	0.80
AIC	7766			7403		
ICC	0.45			0.64		

Note: * p<0.1, ** p<0.05, *** p<0.01
Source: created by the author

4. 3. Variation in pupil achievement

Within- and between-variation tell us variance explained at each level. By comparing the $\hat{t}_{00}$, $(\widehat{Var}(\beta_{0j})) = (\widehat{Var}(\mu_{0j}))$, estimates across two models, we can develop an index of "variance explained" at school level. In this application, the proportion of variance explained in $\beta_{0j} = \hat{t}_{00}$

(Model 0) – $\hat{t}_{00}$(Model 1) / $\hat{t}_{00}$(Model 1) (See details in Raudenbush and Bryk, (2002)). Table 4 shows the variance explained in the multilevel analyses. The variance explained at the pupil level is 17.4 %, and at the school level is 12.7%. The total variance explained is 15.3%. This is the sum of total variance explained at the pupil level and at school level. It means that the final model could explain 15.3% of the reading score.

Table 4: Variance explained in the multilevel analyses

	Reading		
	Pupil	**School**	**Total**
	(N=3299)	(N=185)	
Null model	4383.774	3386.110	7769.884
Final model	3619.280	2956.650	
Variance available	56.42%	43.58%	
Variance explained	17.4%	12.7%	
Total variance explained	9.8%	5.5%	15.3%
Variance left unexplained	46.6%	38.1%	84.7%

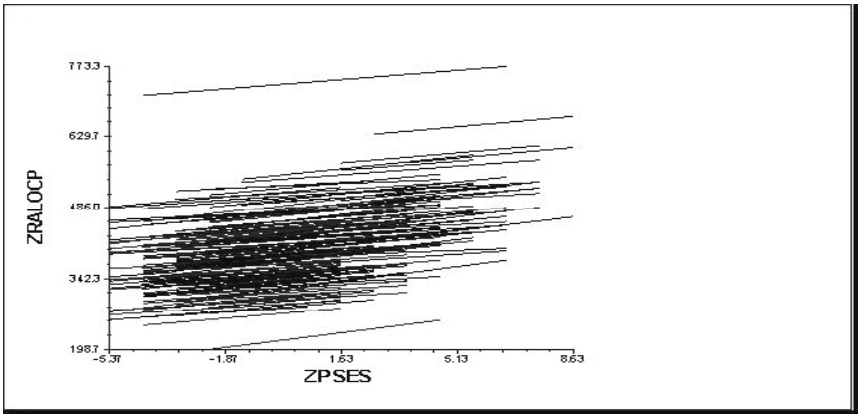
Source: created by the author

5. Discussion

5. 1. Which factors have more influence on student achievement, school or family factors?

The SES variable is statistically significant, and has positive relationship with academic achievement. Figure 5 shows the relationship. Controlling other factors, it indicates that the SES has a positive relationship on reading achievement. Each school shown as a line varies widely in the figure, though the slopes of these lines are almost the same gradients. In addition, the variation among schools tells us that some factors influence the achievement-SES relationship.

Figure 5: Relationship between reading score and socioeconomic status



Source: Created by the author

What kinds of factors influence the between-school variation? It is important to notice that no single variable has a strong impact on academic achievement. Indeed, the educational process is complex and many factors create combination effects. This analysis does not focus on individual cognitive processes, development of academic ability, and the combination effects. If this study considers the combination effects, peer group effects, which are an interactive effect of school and family background factors, might be one of the potential predictors. The peer effects may increase the model fitness.

Another way of understanding the weak effect of the independent variables is because of the high proportion of between-school variation. The high proportion of between-school variation covers and undermines the pure relationship between academic achievement and the variables. For example, Figure 5 implies that SES influences not only individual achievement, but also schools themselves. This study analyzes factors influencing academic achievement based on the assumption that a school is a unit of analysis, not a factor. If SES influences even schools, the effects of pupil-teacher ratio, facilities, type, and location factors should also be a function of SES.

Another family factor, English variable, is the strongest predictor of academic achievement. The result of the standardized version model shows, relatively, the strength of these variables. While the SES variable is composed by quantitative aspects such as parent's education and possessions at home, the English variable is a qualitative aspect such as educational culture in a family. Parents who speak English at home may use English when they talk with their children. It is possible to guess that their children learned how to use English through family life. They use English because they value it.

5. 2. What kind of factors determine higher achieving schools?

The results of the HLM analysis showed that SES might influence schools themselves. A multi-regression analysis at the school level was applied to examine what kind of factors determine higher achieving schools. This analysis used five variables: mean SES, school type, school location, school resources, and pupil-teacher ratio. The dependent variable was aggregated reading score.

Table 5: Multi-regression analysis at school level

Variables	Coefficient		SD
Intercept	0.02		0.06
Mean SES	0.62	***	0.07
School Type	-0.13		0.27
School Location	-0.02		0.05
School Resources	0.11		0.07
Pupil-Teacher Ratio	-0.23	***	0.05
Adjusted R-squared	0.55		
F-statistics	46.31	***	

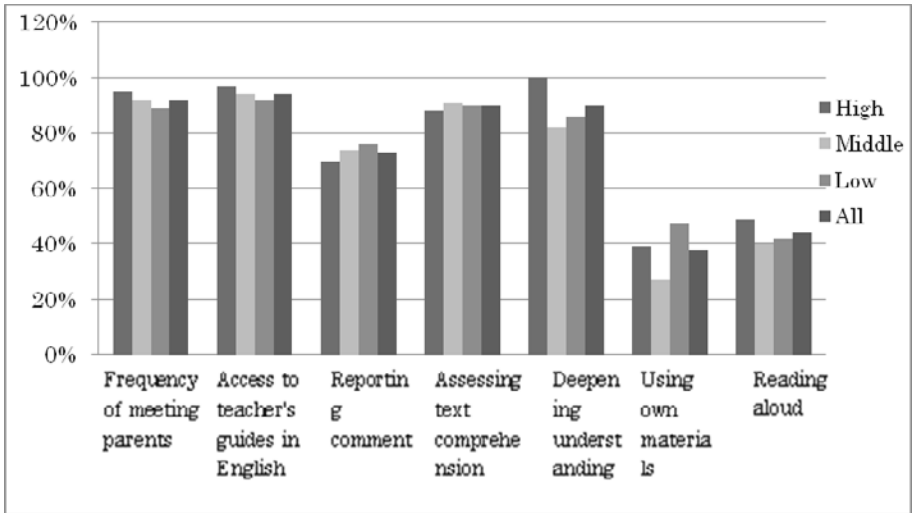
Note: * p<0.1, ** p<0.05, *** p<0.01
Source: created by the author

Table 5 shows the results of the multi-regression analysis at the school level. Two statistically significant variables are the mean SES and the pupil-teacher ratio. The mean SES is positive, and is the strongest predictor for the aggregated reading achievement. The pupil-teacher ratio variable is negative. It means that those who are in smaller sized classes achieve higher performance. School type, school location, school resources are not statistically significant. It implies that school factors do not influence the aggregated reading scores.

In the multi-regression analysis at the school level, school type, school location, and school resources factors did not influence aggregated reading achievement. However, learning process factors may influence pupil achievement. Figure 6 shows the proportion of the learning process variables by school SES levels. The six variables were selected as proxies for the child-centered teaching approach: frequency of meeting parents, access to teacher's guides in English, reporting comment, assessing text comprehension, deepening understanding, using own materials, and reading aloud. The results show there is little difference among the high-, middle-, and low-SES level schools. The two approaches, using own materials and making students reading aloud are relatively small proportions.

Determinants of high achieving schools are the mean SES and pupil-teacher ratio factors. However, it is difficult to decide whether the mean SES and pupil-teacher ratio is a cause of high performing schools, or high performing schools attract pupils who have high SES. In addition, the learning process comparison among schools tells us that child-centered methods do not work well.

Figure 6: The proportion of the learning process in the schools by SES level



Source: Created by the author

6. Conclusion

In this study, two research questions were investigated to analyze the relationship between student achievement and school and family factors. The first research question examined the effect of SES on the achievement among school and individual factors using multilevel analysis. The family background factor significantly affected the reading score, though single predictors did not have enough strength for explaining effects on student achievement. The English variable, the proxy of family culture variable, had the strongest factors for determining student achievement. Qualitative aspects of family background, taking into account geographical and ethnic factors, will be needed for further investigations.

The second research question looked at the factors causing between-school variation in Kenya. This study found a positive relationship between the aggregated socioeconomic status and the aggregated student achievement. It had a strong positive relationship with the aggregated achievement. To examine the characteristics of the schools according to high, middle, and low SES levels, the learning process of the classrooms was compared with the three categorized primary schools in Kenya. Their differences were small in terms of the child-centered teaching approaches, compared to the characteristics of developed countries.

In this study, SES and the English variable are relatively stronger than school factors. However, the variance left unexplained is 84.7 % in Table 4. It means that there are other factors to explain reading scores. Variables such as parent's perception toward the value of education, and the educational culture at home might be potential factors on the family side. On the other hand, factors which were not used, such as school policy, and other learning process factors might be potential factors on the school side.

A combination effect is another area for further studies. If the proxy for peer-group effects is developed, the proxy indicator may influence academic achievement. It is possible that SES also influences schools themselves. This is another type of combination effect. If the combination effect can be controlled, it is helpful to estimate the pure relationship between academic achievement and family and school factors.

Notes

1 SES is a sum of possessions at home, home materials and parent's education, and arranged in 15 levels. Possessions at home are composed by 14 materials; newspaper, magazine, radio, TV, ver., cassette, telephone, fridge, car, motorcycle, bicycle, water, electricity, table. Home materials are divided into 4 materials: wall, floor, roof, and source of lighting. The max is 12. Parent's education is a sum of mother's education and father's education. Both mother and father education range from 1to 6 (1, if a person does not go to school, 2, if they go for some primary, 3, if they go for all primary, 4, if they go for some secondary, 5, if they go for all secondary, and 6, if they go for post secondary). The maximum is 12.

2 If interested in other school effectiveness and school improvement research, see these articles:

Fuller & Clarke (1994), Riddle (1997), Willms & Somers (2001).

[3] This analysis do not use teacher factors, and school type factor (public or private), and province factor, because Hungi (2010) indicates that these variables have little effect on reading score.

[4] English score is transferred to adjust the distribution. Mean is 500, and SD is 100. English variable is 1, if a student speaks often. Otherwise, it is 0 (never/rarely/sometimes). Resource variable is composed by 22 equipments; computer, duplicator, electricity, library, hall, staff room, school head office, store room, first aid, sports ground, water, telephone, fax, garden, typewriter, radio, tape recorder, ohp, tv, vcr, photo copier, fence.

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