Modelling pupils' absenteeism: Emerging policy issues from SACMEQ projects

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Abstract

This study employed a multilevel technique to examine pupil- and school-level factors that influence absenteeism rates among Standard 6 primary school pupils in Kenya. The data used in this study were collected as part of Southern Africa Consortium for Monitoring Educational Quality (SACMEQ) II project in 2002 from 3,299 pupils in 185 schools in eight provinces in Kenya. At the individual level, results show that pupil's age, pupil's home background (SES), number of meals eaten by pupil per week and corrections of the homework given to the pupil significantly influence absenteeism rates in Kenya. At the group level, results show that working places in class (for sitting and writing) and school geographical location (province) significantly influence absenteeism in Kenya. Policy implications of these results are discussed.

1 Introduction

Absenteeism has been associated with undesirable outcomes, such as poor academic achievement and low school internal efficiency (high repetition rates and high dropout rates) and discipline problems. Obviously, students who are regular absentees receive fewer hours of instruction and therefore are highly likely to achieve at a lower level compared to the rest of their classmates. It is not hard to see that frequent absenteeism could lead to less engagement in schoolwork and therefore less motivation to continue with schooling.

A number of research studies in developed countries have reported significant relationships between absenteeism and poor academic achievement (e.g. Monk and Ibrahim,

1984; Moore, 2004; Reynolds and Walberg, 1991; Rumberger and Larson, 1998). For example, Rumberger and Larson (1998), analyzing data from grade 7 (N = 746) and grade 9 (N = 663) students from a large middle school system in California in the United States, found that students with high rates of absenteeism had worse grades than students with moderate rates of absenteeism. Rumberger and Larson also found that students who were absent more than 25 per cent of the time were more than twice as likely to leave school early as were students who were absent less than 15 per cent of the time.

There is also research evidence from developing countries that links absenteeism with low academic achievement. For example, Hungi (2004*a*), using data from 36,476 grade 5 pupils in 7,221 classes in 3,635 schools in Vietnam, found that absenteeism had significant negative effects on pupil achievement in reading and mathematics both at the individual and the class-level. This indicated that high absenteeism rates at the class-level affected regular attendees within the class as well. In the Kenya context at the primary school level, findings from Southern Africa Consortium for Monitoring Educational Quality (SACMEQ) II projects indicate that pupils, who were never (or were rarely) absent from school were more likely to achieve better in reading and mathematics than those pupils who were frequently absent from school (Hungi, 2004*b*). In the SACMEQ I project, Nzomo, Kariuki and Guantai (2001) found that the average absenteeism rate among Standard 6 pupils in Kenya was about two days per month. Nzomo *et al*. (2001) contended that the performance of pupils was greatly affected by absenteeism.

The data for this study were collected as part of the SACMEQ II project in 2002 from 3,299 pupils in 185 primary schools in eight provinces in Kenya. There are two main purposes of the current study. The first purpose is to identify pupil and school-related factors that influence absenteeism among Standard 6 pupils in Kenya. The second purpose is to develop a multilevel model that could be used to explain some of the variance associated with

absenteeism among Standard 6 pupils in Kenya. The multilevel technique employed in this study has been used by Rothman (2000) in his analysis of absenteeism among primary school pupils in South Australia.

The structure of this article is as follows. A section is included in which some preliminary analyses of the data are reported. Two sections are provided in which the hypothesized multilevel model is described and the specifications of this model are outlined. The multilevel analysis is described and, finally, sections containing the results of the analyses are presented and discussed.

2 Some preliminary data analyses

As mentioned in the introduction, data for this study was collected as part of the SACMEQ II project in 2002. A wide range of information about characteristics of pupils, classes, teachers and schools was collected. The variables examined in this study are those variables identified as potential predictors of absenteeism following sound reasoning and research findings from studies in other countries.

The pupils were asked how many days they were absent from school in the previous month. The number of days absent ranged from 0 — 21 days and the average number of days absent was about two days. The percentages of pupils who said they were absent for zero, one, two, three and four days were 48.6, 13.5, 10.1, 8.6 and 4.8 respectively. This means that 85.6 per cent of the pupils were absent from school for four days or less. In other words, 14.4 per cent of the pupils were absent for at least five days (i.e. one school week) in the previous month. The analyses reported in this paper do not distinguish between absenteeism with permission from school authorities and absenteeism without permission from school authorities.

A breakdown of the absenteeism rates by some of the pupil and school level variables examined in this study has been given in *Table 1*. It should be noted that, in the estimation of the statistics shown in *Table 1*, pupil weights and the clustering nature of these data (i.e. pupils nested within schools) were taken into consideration using AM (AIR and Cohen, 2003) computer software. However, in the estimation of the statistics in *Table 1*, the distribution nature of Days absent data (Poisson distribution) was not taken into consideration and the data were assumed to be normally distributed.

<Insert Table 1 about here>

The results in *Table 1* shows that boys' mean absenteeism rate (1.98) closely follows that of girls' (1.94), which indicates that pupil's sex may not be a factor influencing absenteeism rate among Standard 6 pupils in Kenya. The results in *Table 1* indicate that the variable 'Home possession level' could be a factor influencing absenteeism rate. This is because the mean absenteeism rate of pupils from poor homes (2.23) is noticeably larger than that of pupils from rich homes (1.56). Similarly, 'Pupil source of light' could also be a factor related to absenteeism rate according to the results in *Table 1* and *Figure 1*.

Figure 1 is a box plot of the absenteeism rate by 'Pupil source of light' data plotted using SPSS version 10.0 for Windows. When interpreting results obtained using SPSS version 10.0 for Windows, it should be noted that this software does not allow for the clustering nature of the data and therefore gives misleadingly small standard errors when used with multilevel data. Nevertheless, the plot in *Figure 1* provides some evidence that there could be significant differences between the absenteeism rate of pupils from homes with electric lighting and the absenteeism rate of pupils from homes with fire lighting or with no sources of

lighting. A similar plot for Province data (*Figure 2*) indicate that there could be significant differences between the absenteeism rate of pupils attending schools in Rift Valley Province and the absenteeism rate of pupils attending schools in say Nairobi, Eastern and Central Provinces.

<Insert Figure 1 about here>

<Insert Figure 2 about here>

As a word of caution, the multilevel analyses that are reported in later sections of this article should not be expected to give identical results to the results in *Table 1*. This is because some of the differences reported above might not survive when the multilevel nature of the data and the distributional nature of the data have been taken into account in the analyses. Importantly, the results of the multilevel analyses are expected to give a better picture of the effects of various factors on absenteeism rate compared with the results obtained using the approach described above.

3 Hypothesized model

When dealing with multilevel data such as the data in this study, the appropriate procedure is to formulate multilevel models, "which enable the testing of hypotheses about effects occurring within each level and the interrelations among them" (Raudenbush and Bryk, 1994, p. 2590). Consequently, in this study, a two-level model was hypothesized to enable the testing of hypotheses about the factors influencing absenteeism rate among Standard 6 pupils in Kenya. The hierarchical structure of this model was obtained using pupils at level-1 and schools at level-2. In other words, pupils were nested within schools.

In this two-level model, 12 and 37 variables (see *Table 1*) were initially hypothesized to influence directly pupil absenteeism rate at the pupil and school levels respectively. In general, there were three types of variables examined for inclusion in the model at the school level. The first types of variables were student-related variables (i.e. school context) constructed by aggregating the pupil-level data. For example, pupil-level data on the variable 'Age in years' were aggregated at the school level in order to construct the variable 'Average age in years' at the school level. The second types of variables were student-free variables constructed from school characteristic data (e.g. School location), teachers' characteristics data (e.g. School head sex) and community characteristics data (e.g. Community contribution towards school development). The third types of variables were province-related dummy variables — constructed by disaggregating province level data (e.g. Central Province: Schools in Central Province = 1, All other schools = 0).

The names and codes of all the predictor variables tested (whether significant or not) for inclusion at each level of the two-level hierarchical model are provided in *Table 1*. All variables for which data were available for testing are listed in *Table 1*, to show the very extensive range of possible effects that were examined, rather than to provide information only on those that were statistically significant. The lack of statistical significance can sometimes be of great interest in development or modification of policy.

It should be noted that the variables 'Socioeconomic background (SES)' and 'Pupil's source of light (LIGHT)' are listed in *Table 1* together because they are considered to be alternative versions of the same underlying measure ('Home background'). Therefore, to avoid problems associated with multicollinearity and suppressor relationships (Keeves, 1997), these two variables have not been added into the model together. The correlation between these two variables was moderate (0.44). For the same reason, the variables constructed by

aggregated pupil-level data on these two variables at the school level (SES_2 and LIGHT_2) are listed together in *Table 1*.

4 Specification of the model

The distribution of the outcome variable ('Days absent') followed a Poisson distribution (see *Figure 3*). When the distribution of the outcome variable is Poisson, HLM5 (Raudenbush, Bryk, Cheong and Congdon, 2000*a*) uses log link function. Thus, for this study, and following the notations and arguments presented by Raudenbush and Bryk (2002), the two-level Poisson model for the estimation of pupil absenteeism rate, can be described as follows.

Level-1 model

At the micro-level, the log of pupil absenteeism rate is modelled as a function of school mean and pupil-level background variables:

$$\log(\lambda_{ij}) = \beta_{0j} + \beta_{hj} X_{hij} \qquad \textbf{Equation 1}$$

where:

λ_{ij} is the absenteeism rate of pupil *i* in school *j*;

β_{0j} is the log of the mean absenteeism rate of school *j*;

X_{hij} are the background characteristics of pupil *i* in school *j;* and

β_{hj} are the logs of regression coefficients associated with the pupil background characteristics of school *j*.

The indices *i*, and *j* denote pupils and schools. There are

i = 1, 2, . . . , n_j pupils within school j; and

j = 1, 2, . . . , J schools (in this study, J = 185);

For parsimony, $\beta_{hj}X_{hij}$ in Equation 1 represents the control for several relevant independent variables $(\beta_{1j}X_{1ij} + \beta_{2j}X_{2ij} + \ldots + \beta_{hj}X_{hij})$ that describe pupil's background characteristics. There are *h* = 1, 2, . . . , H (in this study, H = 12) independent variables which describe student's background characteristics. Hence, for the current study, X_{hij} represents a combination of any of the 12 pupil-level variables listed in *Table 2*.

Level-2 model

At the macro-level of the model, the intake-adjusted log of absenteeism rate, β_{0j}, is regressed on school-level variables (W_{gj}) for each school.

$$\beta_{0j} = \gamma_{00} + \gamma_{0g}W_{0gj} + u_{0j} \qquad \textbf{Equation 2}$$

where:

γ_{00} is the log of the mean absenteeism rate of all schools (grand-mean),

γ_{0g} are the logs of the slopes associated with the school-level variables; and

u_{0j} is a random error associated with school *j*.

For parsimony, $\gamma_{0g}W_{0gj}$ in Equation 2 represents the control for several relevant school-level variables $(\gamma_{01}W_{01j} + \gamma_{02}W_{02j} + \ldots + \gamma_{0g}W_{0gj})$ that describe the school context, school characteristics, teachers' characteristics and community characteristics. There are *g* = 1, 2, . . . , G (in this study G = 37) school-level variables. Hence, for the current study W_{gj} represents a combination of any of the 37 school-level variables listed in *Table 2*.

In addition, at this level of the model each component that is associated with the pupil background characteristics, (β_{hj}) is viewed as an outcome varying randomly around some school mean (γ_{h0}), that is:

$$\beta_{1j} = \gamma_{10} + u_{1j}$$
$$\beta_{2j} = \gamma_{20} + u_{2j}$$
$$\vdots$$
$$\beta_{hj} = \gamma_{h0} + u_{hj}$$

Equation 3

For purposes of simplicity, cross-level interaction effects have been excluded from Equation 3 above, but in actual analyses, cross-level interaction effects were examined. However, no cross-level interaction effects were significant in this study.

5 Method

A preliminary task in HLM analyses was to build a sufficient statistics matrix (SSM) file. No pupils or schools were dropped due to insufficient data in the construction of this SSM file. Consequently, the Ns in this SSM file remained as they were in the original data files; that is, 3299 for pupils and 185 for schools.

The first step undertaken in HLM analyses was to specify the outcome variable, which is ABSENT ('Days absent'). The distribution of this outcome variable followed a Poisson distribution (see *Figure 3*). Thus, the second step undertaken was to set up a non-linear model (Poisson, with constant exposure) using the optional specification menu available in HLM5. The third step undertaken was to run a null model in order to obtain the amount of variance available to be explained at each level of the hierarchy. The null model was the simplest model because it contained only the dependent variable (for this study, number of days absent) and no predictor variables were specified at any level.

<Insert Table 2 about here>

The fourth step undertaken was to build up the pupil-level model or the so-called 'unconditional' model at level-1. This involved adding pupil-level predictors to the model, but without entering predictors at the school level. The purpose of this step was to examine which pupil-level variables had significant ($p<0.05$ level) effects on the outcome variables. An approach referred to as a 'step-up' approach (Bryk and Raudenbush, 1992) was followed to examine which of the pupil-level variables had a significant influence on days absent from school in the hypothesized model. Bryk and Raudenbush (1992) recommended the step-up approach for inclusion of variables into the model to the alternative approach referred to as 'working-backward' where all the possible predictors are included in the model and then the non-significant variables are progressively eliminated from the model.

It should be noted that, in this study, all pupil-level predictor variables were grand-mean-centred in the HLM analyses so that the intercept term would represent the average number of days absent for the schools.

The final step in the HLM analyses involved adding the level-2 (school) predictors into the model using the step-up strategy mentioned above. The level-2 exploratory analysis sub-routine available in HLM5 was employed for examining the potentially significant level-2 predictors (as shown in the output) in successive HLM runs.

It is worth noting that the Poisson option of HLM5 generates two main solutions, one for the so-called 'unit-specific' model, and the other referred to as the 'population-average' model (Raudenbush, Bryk, Cheong and Congdon, 2000*b*, p. 128). Raudenbush and Bryk (2002, p.301) note that "though inferences based on these two models are often quite similar, the models are oriented towards somewhat different research aims".

In this study, the unit-specific model is useful if examining how differences in pupil (or school) characteristics are related to absenteeism rate holding constant the school attended, that is, absenteeism rate for the same kind of schools, schools sharing the same value of u_{0j} in

Equation 2 above. On the other hand, the population-average model is useful when examining how differences in pupil (or school) characteristics are related to absenteeism rate for all schools nationwide, that is, the difference of interest averaging over all possible values of u_{0j} in Equation 2 (see Raudenbush *et al*. 2000*b*, pp. 128–130). For purposes of generalizing findings across schools in Kenya, the results discussed in this study are from the population-average model.

In addition, the Poisson option produces model-based standard errors and robust standard errors for the population-average model. Raudenbush and Bryk (2002) have argued that, for a given coefficient, if the model-based standard error is markedly different from the robust standard error it gives evidence of misspecification of random effects. Consequently, Raudenbush and Bryk have recommended comparing these two types of standard errors when making a decision on whether to specify the regression coefficient as 'fixed' or 'random'. For this study, specifying a coefficient as fixed involves constraining it to be the same across all schools while specifying it as random allows it to vary among schools.

6 Results and discussion

The final two-level model for days absent from school has been presented below in equation form.

Level-1 model

$$\log(\lambda_{ij}) = \beta_{0j} + \beta_{1j}(MEALS)_{ij} + \beta_{2j}(HMKRMC)_{ij} + \beta_{3j}(AGE)_{ij} + \beta_{4j}(SES)_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(WPLACE\_2)_j + \gamma_{02}(WESTERN)_j + \gamma_{03}(RTVALLEY)_j + u_{0j}$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$
$$\beta_{4j} = \gamma_{40} + u_{4j}$$

Equation 4

The above equation indicates that, for example, the absenteeism rate of Pupil 1 who ate average number of meals per week was expected to be $\exp(\beta_1)$ times the absenteeism rate of Pupil 2 who ate meals one standard deviation below the average number of meals per week if all other factors were equal. By way of another example, the above equation indicates that the absenteeism rate of Pupil 3 attending a school in Western Province was expected to be $\exp(\gamma_{02})$ times the absenteeism rate of Pupil 4 attending a school in another province assuming all other factors were equal.

Estimates for both the unit-specific and the population-average models have been presented in *Table 3* for the null, level-1 unconditional and final models. The multiplier effects in *Table 3* were calculated by taking the exponential (exp) of the estimated coefficient. The descriptive statistics of the variables included in the final model have been given at the bottom of *Table 3*. These descriptive statistics are from HLM analyses.

As mentioned above, discussion in this study is based on the population-average model. Nevertheless, the unit-specific model estimates have been provided in *Table 3* to allow interested readers to make comparisons with the population-average model estimates. It can be seen from *Table 3* that, apart from the intercept, the coefficient estimates based on population-average model follow closely those based on the unit-specific model. In addition, the model-based standard errors follow closely the robust standard errors and therefore there is no evidence of misspecification of random effects.

In interpreting the results in *Table 3*, it is worth noting that signs of coefficients indicate directions of effects and can be interpreted meaningfully if the codings of the variables are considered. For example, the negative coefficient for 'Socioeconomic status' (SES) indicates that pupils from low SES homes were estimated to have higher absenteeism

rates than pupils from high SES homes. The following examples illustrate the meaning of the results presented in *Table 3*.

<Insert Table 3 about here>

For the null population-average model, the predicted average number of days absent for schools is 1.90 (that is, $\exp[0.64]$) with a variance of 0.38. Thus, the intercept of the null model shows that 95 per cent of the schools were expected to have absenteeism rates in the interval $\exp(0.64 \pm \sqrt{0.38} * 1.96)$, which is equal to (0.57, 6.35). For the final population-average model the intercept, $\exp(0.48) = 1.62$, is the estimated average number of days absent for schools, controlled for Rift Valley and Western Provinces, and assuming that all schools have pupils with the same pupil-level characteristics and that all school-level factors are equal across schools. The 95 per cent confidence interval for the final population-average model intercept is $\exp(0.48 \pm \sqrt{0.29} * 1.96)$, which is equal to (0.56, 4.64).

The multiplier effect [=exp(coefficient)] of a pupil-level variable is the estimated absenteeism rate of a pupil with a mean score of that variable, which is also the estimated change in number of days absent due to a one standard deviation change in that predictor variable. For example, for the population-average model, if all other factors are equal, Standard 6 pupils of average age (13.9 years) were estimated to have 1.07 times the absenteeism rate of pupils of age one standard deviation below the mean age (that is, 13.9 - 1.6 = 12.4 years). For the dummy variable WESTERN, the multiplier effect indicates that, if all other factors were equal, pupils attending schools in Western Province were estimated to have exp(0.32) = 1.38 times the absenteeism rate of pupils attending schools in other provinces in Kenya, based on the final population-average model.

6.1 Pupil-level model

From *Table 3*, it can be seen that four of the 12 pupil-level variables (listed in *Table 2*) examined in this study had significant influences on days absent from school. These four pupil-level variables were 1) Age in years, 2) Socioeconomic status, 3) Meals per week, and 4) Homework corrected.

In summary, the following effects on absenteeism were recorded among Kenyan Standard 6 pupils when other factors were equal.

Age in years: Older pupils in Standard 6 in Kenya were estimated to have higher absenteeism rates than their younger counterparts attending the same school. It is likely that the older pupils felt discouraged to be in the same grade level with younger pupils. Thus, education policy should emphasize that children should enter school at the designed age and very few should repeat grades.

Socioeconomic status: Pupils from homes with better quality houses, many possessions, more educated parents and who had the most learning materials had lower absenteeism rates than pupils from homes with low quality houses, few or no possessions, less educated parents and who had hardly any learning materials. Parents of high socioeconomic status are often well educated and they show interest in their children learning in school and encourage children to go to school. Such parents often provide their children with basic learning materials, such as pens and pencils. Clearly, it is important for pupils to have basic learning materials to go to school as well as for academic progress in general. In most cases, poor parents cannot afford to buy these learning materials for their children. Fortunately, under the Free Primary Education (FPE) program in Kenya, the government now provides these learning materials for pupils, which is a major step towards solving this problem. Before the introduction of FPE program in 2003 in Kenya, provision of these learning materials was left to parents, rich or poor.

Meals per week: Pupils who ate more meals per week had lower absenteeism rates than pupils who ate fewer meals per week. Thus, the government should assist parents by starting School Feeding Programs (SFP) to ensure that all children receive enough meals per week so that they can learn effectively and be motivated to attend school.

Homework corrected: Pupils who were given homework (in reading and mathematics) more frequently and had it corrected were estimated to have lower absenteeism rates than pupils who were given homework and had it corrected less frequently. Thus, in order to motivate pupils to come to school, all teachers should give homework more frequently and should make sure that they correct the homework. Head teachers and the Quality Assurance and Standards Division should monitor the homework given to pupils and the corrections by teachers of the homework given.

6.2 School-level model

At the school-level, out of the 37 variables examined in the HLM analyses (listed in *Table 2*), only three had significant influences on days absent. These three variables were 'Average working place', 'Western Province' and 'Rift Valley Province'. Thus, other factors being equal, the following effects on absenteeism rate were identified (*Table 3*) among Standard 6 pupils in primary schools in Kenya.

Average working place: Pupils in schools where pupils had their own working places in class (for sitting and writing) were estimated to have lower absenteeism rates than their counterparts in schools where pupils shared working places or had no working places in class. Clearly, pupils might feel discouraged from going to school if they have to spend the whole day in uncomfortable working places because of lack of furniture or over crowding in classrooms. This implies that MoEST, through the Quality Assurance and Standards Division, should ensure that every class has sufficient working places for all pupils to be able to sit and write.

Western and Rift Valley Provinces: Pupils attending schools in Rift Valley and Western Provinces were estimated to have higher absenteeism rates than pupils attending schools in the other six provinces in Kenya. This is a serious problem and the government should commission studies to examine the reasons for high absenteeism rates in these two provinces and to identify ways of correcting these problems.

6.3 Variance explained

As can be seen from the results in *Table 3*, the predictors included in the final model explained 23.7 per cent of the school-level variance, which meant that 76.3 per cent of the total school-level variance was left unexplained. This large amount of the variance left unexplained indicated that there were other important pupil, class or school level factors influencing pupils absenteeism that have not been included in the models developed in this study.

Certain important pupil-level variables that were not available for examination in this study include parents and close relatives with HIV/AIDS-related problems, academic motivation, future job aspirations and prior achievement. In addition, certain class-level variables such as classroom resources, class composition, characteristic of class teacher and quality of instructions could be important predictors of absenteeism. Clearly, it would be interesting to repeat this multilevel analysis based on a model that includes a class level and an examination of the variables suggested above.

7 Conclusions

The purpose of this study was to identify pupil and school level factors influencing absenteeism among Standard 6 pupils in Kenya and to develop a multilevel model that could be used to explain some of the school-level variance associated with absenteeism among these pupils. The study utilized data from SACMEQ II project consisting of 3,299 pupils attending 185 schools in eight provinces in Kenya.

In order to achieve the above purposes a two-level model was hypothesized and examined using HLM5 software. The results of the multilevel analysis showed that four of the 12 pupil-level variables examined in this study had some significant effects on the number of days absent from school. These four pupil-level variables were 'Age in years', 'Socioeconomic status', 'Meals per week' and 'Homework corrected'.

From these pupil-level results, the following conclusions were drawn regarding absenteeism rates among Standard 6 pupils in Kenya when other factors are equal. Older pupils were estimated to have higher absenteeism rates than their younger counterparts, while pupils from high socioeconomic status homes were estimated to have lower absenteeism rates than pupils from low socioeconomic status homes. In addition, pupils who ate more meals per week were estimated to have lower absenteeism rates than pupils who ate fewer meals per week. Finally, pupils who were given homework (in reading and mathematics) more frequently and had the homework corrected were estimated to have lower absenteeism rates than pupils who were given homework less frequently and had the given homework corrected less frequently.

At the school level, the results of the analyses reported here show that of the 37 school level variables examined in this study, three variables had significant ($p<0.05$) effects on number of days absent from school. These three variables were 'Average working place', 'Western Province' and 'Rift Valley Province'. When other variables were equal, these school level results showed the following findings regarding absenteeism rates among Standard 6 pupils in Kenya. Pupils in schools where pupils had their own working places in class (for sitting and writing) were estimated to have lower absenteeism rates than their counterparts in schools where pupils shared working places or had no working places in class. In addition, pupil-attending schools in Western and Rift Valley Provinces were estimated to have higher absenteeism rates than pupils attending schools in the other six provinces in Kenya.

The multilevel model developed in this study explained only 23.7 per cent of the school-level variance. This large percentage of school-level variance left unexplained strongly indicated that there were other important pupil or class-level factors that were influencing absenteeism, which were not been included in the models developed in this study.

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Table 1 Pupil absenteeism rates

Divided by pupil level variables	N	Weighted N	Mean absence	Standard error
Total sample	**3299**	**3299**	**1.96**	**0.10**
Pupil sex				
Boy	1695	1638	1.98	0.12
Girl	1604	1661	1.94	0.11
Speaking English at home				
Never	386	449	2.40	0.23
Sometimes/Always	2913	2850	1.89	0.10
Pupil source of light at home				
No light/Fire	124	137	2.71	0.38
Candle/Paraffin oil/Gas lamp	2397	2610	2.00	0.10
Electricity	778	552	1.59	0.20
Home possession level				
Low	1799	1959	2.23	0.13
High	1500	1340	1.56	0.11
Exercise books				
Have at least 1	3176	3166	1.94	0.10
No exercise book	123	133	2.42	0.45
Pencils				
Have at least 1	3083	3063	1.88	0.09
No pencil	216	236	2.91	0.41
Pens or ball point pens				
Have at least 1	2759	2759	1.90	0.10
Have no pen or ball point pens	540	540	2.24	0.20
Extra tuition				
No extra tuition	494	406	1.94	0.20
Takes extra tuition	2805	2893	1.96	0.10
Grade repetition				
Never	1397	1183	1.80	0.13
Once	1337	1450	1.97	0.12
Twice	450	527	2.05	0.17
Three plus	115	139	2.82	0.44
Sitting place				
No sitting place/Share	24	26	3.76	0.79
Have own sitting place	3275	3273	1.94	0.10
Writing place				
No writing place/Share	120	129	2.61	0.28
Have own writing place	3179	3170	1.93	0.10
Reading homework given				
None/1-2 per m/1-2 per wk	1199	1168	2.25	0.16
Most days	2100	2131	1.80	0.11
Reading homework corrected				
Never corrects	111	123	2.24	0.25
Sometimes corrects	941	978	2.14	0.15
Most of the time/Always corrects	2170	2126	1.83	0.10
Mathematics homework given				
None/1-2 per m/1-2 per wk	993	1037	2.36	0.17
Most days	2306	2262	1.77	0.10

(Continued)

Table 1 Pupil absenteeism rates *(Continued)*

	N	Weighted N	Mean absence	Standard error
Mathematics homework corrected				
Never corrects	79	87	4.08	0.58
Sometimes corrects	765	824	2.08	0.17
Most of the time/Always corrects	2414	2346	1.84	0.10
Own reading textbook				
No text or share	2415	2414	2.04	0.12
Have my own text	884	885	1.74	0.13
Own mathematics textbook				
No text or share	2529	2526	2.04	0.12
Have my own text	770	773	1.69	0.15
Pupil place of living				
With parents or relatives	3004	2965	1.91	0.10
In a hostel or alone	295	334	2.39	0.31
Divided by school level variables				
Province				
Central	443	593	1.53	0.18
Coast	353	202	1.85	0.31
Eastern	444	569	1.57	0.22
Nairobi	372	102	1.40	0.24
North Eastern	277	20	1.63	0.27
Nyanza	424	590	1.99	0.21
Rift Valley	533	789	2.46	0.27
Western	453	435	2.29	0.23
School head sex				
Male	2873	2988	1.95	0.10
Female	409	286	2.09	0.29
School head age level				
27 or below	18	55	1.61	0.00
28 to 32	254	199	2.84	0.49
33 to 37	520	511	1.71	0.32
38 to 42	874	820	1.74	0.18
43 to 47	1050	1092	2.09	0.15
55 or above	566	597	2.00	0.19
School head teacher training				
One year or less	38	15	0.23	0.29
Two years	3012	3018	2.00	0.10
Three years	78	59	1.16	0.20
Four years or more	140	160	1.91	0.26
School location				
Isolated/Rural	1818	2204	2.02	0.11
Small town	634	621	1.97	0.29
Large city	830	448	1.71	0.22
Routine inspection				
No inspection	206	144	2.02	0.33
At least 1 inspection	3076	3130	1.96	0.10

(Continued)

Table 1 Pupil absenteeism rates *(Continued)*

	N	Weighted N	Mean absence	Standard error
School building condition				
Minor repair/Good	2211	2198	1.94	0.12
Rebuilding/Major repair	1071	1075	2.03	0.17
School head teaching minutes per week				
499 or less	505	307	1.63	0.27
500 to 999	1363	1381	1.97	0.15
1000 or more	1414	1586	2.02	0.15
Borrowing books from school				
Cannot borrow	2496	2652	1.99	0.12
Can borrow	803	647	1.81	0.22
Reading tests				
No test/1 per year/1 -2-3 term	291	290	2.17	0.39
2 or 3/month	701	653	2.03	0.21
1+ per week	2127	2171	1.91	0.12
Mathematics tests				
No test/1 per year/1 -2-3 term	730	715	2.22	0.24
2 or 3/month	1496	1449	1.75	0.14
1+ per week	988	1028	2.08	0.18

Note:
The mean absences and standard errors (SE) presented are those obtained using weighted N and taking into account the clustering nature of this data (i.e. pupils nested within schools and schools nested within provinces) using AM (AIR and Cohen, 2003). However, it should be noted that the means and standard errors were calculated on a seriously skewed distribution.

Table 2 Variables tested on each level of the hierarchy

	Variable of interest	Variable(s) tested in HLM	
Pupil	Age in years	AGE	
	Pupil sex	SEX	
	Speaking English at home	ENGLISH	
	Socioeconomic status/Pupil's source of light	SES/LIGHT	ab
	Books at home	BOOKSH	
	Meals per week	MEALS	
	Grade repetition	REPEAT	
	Extra tuition	EXTRAT	
	Homework corrected (Reading, Mathematics)	HWKRMC	a
	Own textbook (Reading, Mathematics)	RMTEXT	a
	Pupil living alone	ALONE	
	Working place (Sitting, Writing)	WPLACE	a
School	Average pupils' age	AGE_2	
	Proportion of girls	SEX_2	
	Average speaking English	ENGLIS_2	
	Average Socioeconomic status/Pupils' source of light	SES_2/LIGHT_2	b
	Average books at home	PBOOK_2	
	Average meals per week	MEALS_2	
	Average grade repetition	REPEAT_2	
	Average extra tuition	EXTRAT_2	
	Average homework	HWKRMC_2	
	Average own textbook	RMTEXT_2	
	Proportion of pupils living alone	ALONE_2	
	Average working place	WPLACE_2	
	Average class size	CSIZE	
	School head gender	HSEX	
	School head age level	HAGELVL	
	School head training	HQTT	
	School head teaching hours	HEADTCH	
	School location	LOCATION	
	Pupil-teacher ratio	PTRATIO	
	School size	SSIZE	
	Pupil-toilet ratio	PTIOLET	
	School resources	RESOURCE	a
	Pupils' behaviour	PBEHAVE	a
	Teachers' behaviour	TBEHAVE	a
	Community contribution	COMUNITY	a
	Borrowing books	BKBORROW	
	Frequencies of tests	RMTESTS	a
	Regular inspections	INSPECT	
	School building conditions	BLDCOND	
	Central Province	CENTRAL	
	Eastern Province	EASTERN	
	Western Province	WESTERN	
	Nairobi Province	NAIROBI	
	Coast Province	COAST	
	North Eastern Province	NRTEAST	
	Nyanza Province	NYANZA	
	Rift Valley Province	RTVALLEY	

Notes:

a This is a composite variable (Principal component). The simple variables involved in the formation of this variable and their loadings have been given in the Appendix.

b These variables are listed together because they are considered as alternative versions of the same measure and therefore were not included in the model simultaneously.

Table 3 Model for absenteeism rates among Standard 6 pupils in Kenya

		Unit-specific model			Population-average model			
		Coefficient	**Model SE**	**Multiplier** [exp(coeff)]	**Coefficient**	**Model SE**	**Robust SE**	**Multiplier** [exp(coeff)]
Null model								
School	Intercept, γ_{00}	0.50	0.05	1.65	0.64	0.05	0.05	1.90
Pupil	Intercept variance, τ_{00}	0.38			0.38			
Level-1 unconditional model								
School	Intercept (Grand mean), γ_{00}	0.48	0.05	1.62	0.61	0.05	0.05	1.84
Pupil	MEALS (Meals per week), γ_{10}	-0.02	0.01	0.98	-0.02	0.01	0.01	0.98
	HWKRMC (Homework corrected), γ_{20}	-0.08	0.02	0.92	-0.08	0.03	0.03	0.92
	AGE (Age in years), γ_{30}	0.07	0.02	1.07	0.09	0.02	0.02	1.09
	SES[a] (Socioeconomic status), γ_{40}	-0.10	0.03	0.90	-0.07	0.03	0.03	0.93
	Intercept variance, τ_{00}	0.34			0.34			
	Level-2 variance explained	10.5%			10.5%			
Final model								
School	Intercept (Grand mean), γ_{00}	0.37	0.06	1.45	0.48	0.06	0.06	1.62
	WPLACE_2 (Av. working place), γ_{01}	-0.29	0.11	0.75	-0.28	0.10	0.07	0.76
	WESTERN (Western Province), γ_{02}	0.35	0.14	1.42	0.32	0.13	0.11	1.38
	RTVALLEY (Rift Valley Province), γ_{03}	0.38	0.13	1.46	0.38	0.12	0.11	1.46
Pupil	MEALS (Meals per week), γ_{10}	-0.02	0.01	0.98	-0.02	0.01	0.01	0.98
	HWKRMC (Homework corrected), γ_{20}	-0.07	0.03	0.93	-0.07	0.02	0.03	0.93
	AGE (Age in years), γ_{30}	0.07	0.02	1.07	0.07	0.02	0.02	1.07
	SES[a] (Socioeconomic status), γ_{40}	-0.08	0.03	0.92	-0.08	0.03	0.03	0.92
	Intercept variance, τ_{00}	0.29			0.29			
	Level-2 variance explained	23.7%			23.7%			

Notes:

SE - Standard Error.

[a] - Regression coefficient of this variable was specified as 'varying'.

Level-1 descriptive statistics

Variable	N	Mean	SD	Min.	Max.
ABSENT	3299	1.88	2.92	0.00	26.00
HMWKRMC	3196	0.00	1.00	-3.80	0.72
AGE	3299	13.94	1.59	10.67	20.83
SES	3272	0.00	1.00	-2.34	5.92
MEALS	3299	19.19	3.45	3.00	21.00

Level-2 descriptive statistics

Variable	J	Mean	SD	Min.	Max.
WPLACE_2	185	0.00	0.44	-3.36	0.19
WESTERN	185	0.14	0.34	0.00	1.00
RTVALLEY	185	0.16	0.37	0.00	1.00

Figure 1 Absenteeism rate by Pupil's source of light

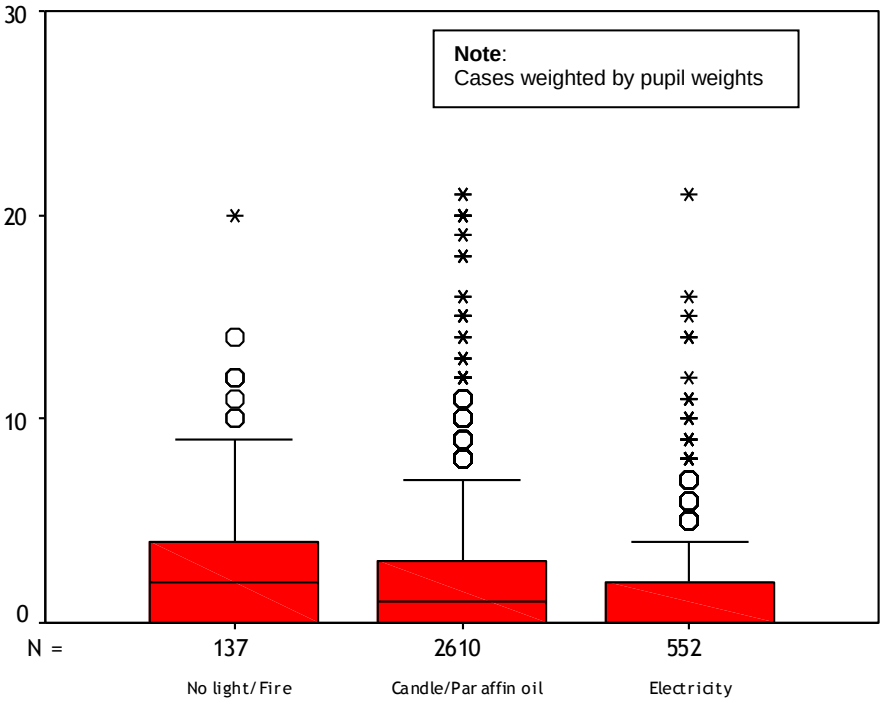
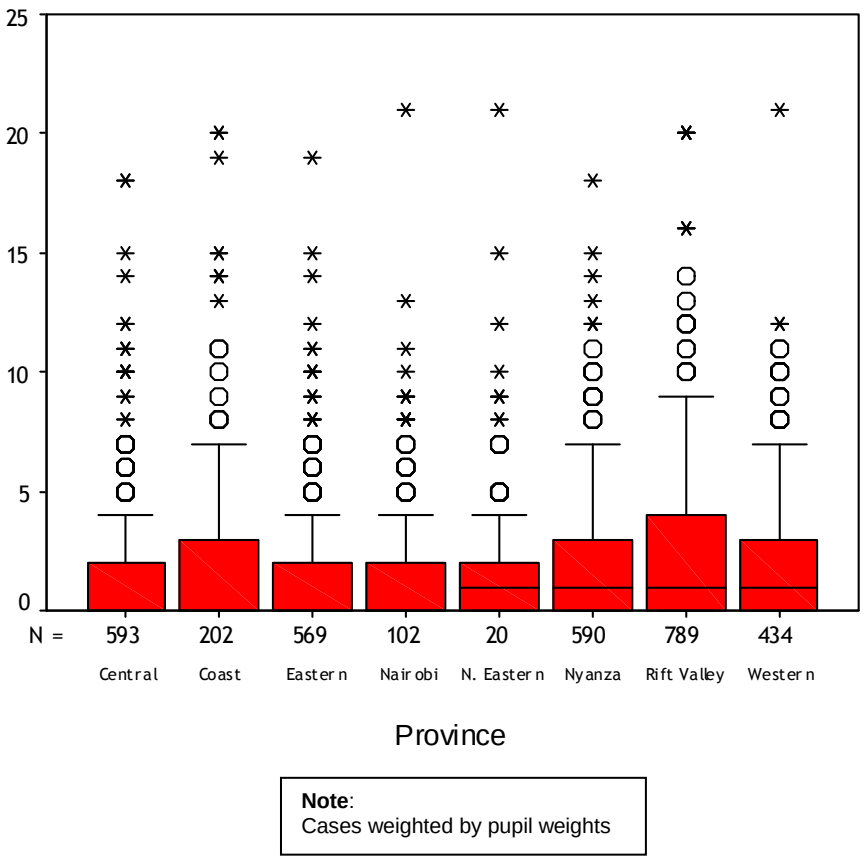
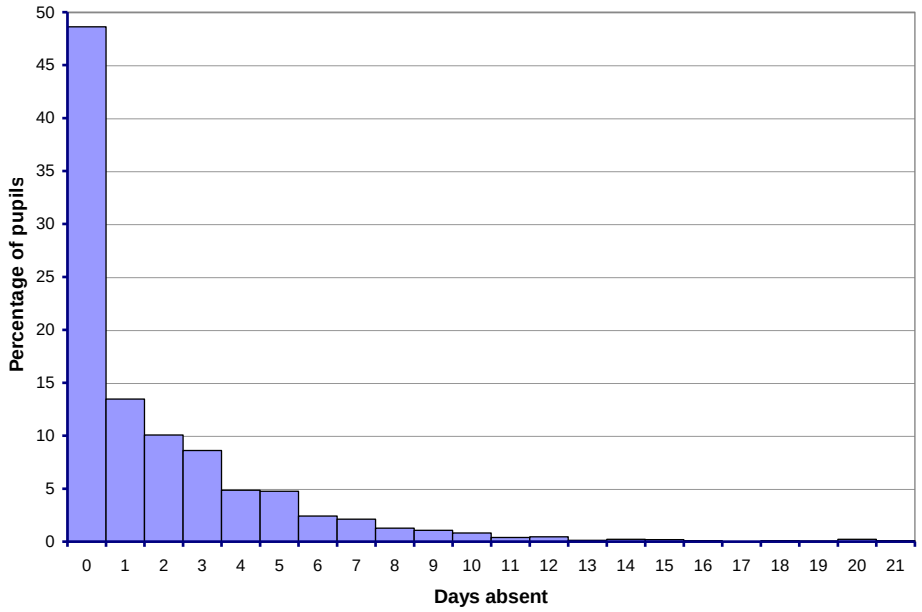


Figure 2 Absenteeism rate by Province



Note:
Cases weighted by pupil weights

Figure 3 Distribution of number of days absent



9 Appendix
Names and factors loadings of the variables used to construct composite variables

Factor	Variables	Loadings
SES		
	Possessions at home	0.54
	Quality of house	0.55
	Parents' education	0.53
	Pencils	0.54
	Sharpeners	0.56
	Erasers	0.56
	Rulers	0.50
	Pens or ball point pens	0.55
	Files	0.49
PBEHAVE		
	Arrive late	0.62
	Skip class	0.56
	Dropout	0.41
	Classroom disturbance	0.57
	Cheating	0.67
	Language	0.76
	Vandalism	0.78
	Theft	0.69
	Bullying pupils	0.67
	Bullying staff	0.73
	Injure staff	0.60
	Sexually harass pupils	0.61
	Sexually harass teachers	0.44
	Drug abuse	0.59
	Alcohol abuse	0.54
	Fights	0.61
HMKRMC		
	Reading homework corrected	0.85
	Maths homework corrected	0.85
RMTEXT		
	Own reading textbooks	0.90
	Own maths textbooks	0.90
WPLACE		
	Sitting place	0.75
	Writing place	0.75
RMTESTS		
	Reading tests	0.79
	Mathematics tests	0.79

Factor	Variables	Loadings
TBEHAVE		
	Arrive late	0.57
	Absenteeism	0.68
	Skip class	0.67
	Bully pupils	0.58
	Harass sexually pupils	0.54
	Language	0.64
	Drug abuse	0.45
	Alcohol abuse	0.65
	Health problem	0.46
RESOURCE		
	Library	0.40
	Hall	0.49
	First aid	0.44
	Electricity	0.72
	Telephone	0.73
	Fax	0.61
	Typewriter	0.57
	Duplicator	0.76
	Tape recorder	0.54
	TV	0.75
	VCR	0.72
	Photocopier	0.62
	Computer	0.69
	Cafeteria	0.36
COMUNITY		
	Build facility	0.68
	Maintain facility	0.86
	Furniture equipment	0.87
	Textbooks	0.75
	Stationery	0.83
	Other materials	0.83
	Exam fees	0.63
	Staff salary	0.53
	Extra curricular	0.50

Note:
Factor - Principal component factor