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Examining the impact of age on literacy achievement among grade 6 primary school pupils in Kenya

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ABSTRACT

The main objective of this paper is to investigate the optimal age category at which primary school pupils from low income families perform their best in literacy at grade 6 level. Age is a potential learning barrier because of its link to cognitive development as well as its influence on interactions between pupils within classrooms. The sample consisted of 7041 grade 6 pupils, spread in 226 schools across six major urban slums in Kenya. Using descriptive statistics, we examine the distribution of grade 6 pupils' age. We then examine incidences of over-age pupils and incidences of grade repetition across various subgroups of pupils disaggregated by factors such as sex, wealth background, grade repetition, school type and geographical location. Finally, using multilevel techniques, we estimate the pupil age category that has greatest positive impact on literacy achievement at grade 6 after controlling selected pupil and school factors.

Irrespective of pupil sex, grade repetition, wealth background, school type or geographical location the results indicate that grade 6 pupils perform their best in literacy when they are in the age category ranging from 10 years 6 months to 11 years 5 months. The results also indicate that, in general, younger pupils were likely to achieve better than older pupil in literacy regardless of the background under consideration. Implications of the findings for policy and practice as well as further research are outlined.

1. Introduction

This study investigates the optimal age at which grade 6 primary school pupils from low income families perform their best in English literacy. Age is a barrier to learning because of its link to cognitive development as well as its influence on classrooms interactions (Huitt et al., 2009; Hattie, 2008). Under the universal primary education policy, governments have made tremendous achievement in bringing children to school. However, challenges remain in the quality of education provided in schools.

Quality of education has remained low because of the various learning barriers. Pupil's age has been linked to learning achievement but the effects are mixed. Some studies have reported older pupils outperforming the younger ones; others have reported the reverse yet others reported no noticeable difference (see for example Zhong, 2012; Hungi and Thuku, 2010a,b; Ngware et al., 2010; Sharp et al., 2009; Fantuzzo et al., 2007; Datar, 2006). Specifically, younger pupils in developing countries do better than their older peers (See for example Dougan and Pijanowski, 2011; McCoach et al., 2006). In spite of this evidence, the optimal age at which pupils in specific grade achieve the best results is unknown. Understanding the optimal age at which pupils achieve their best is critical because of implications for age at school entry and delayed grade progression. Additionally, information on optimal age that produces best results can guide teachers on selecting learning and teaching materials that are age sensitive.

Relatively younger pupils for their grade experience age-related learning difficult perhaps because they are cognitively not ready for the curriculum content. This is because the curriculum is implemented in hierarchal way with pupils in the initial grades who are supposed to be younger being exposed to easy content. As pupil progress to higher grades they become older and the content also becomes difficult. Relatively older pupils for their grade also experience age-related learning difficult perhaps because of poor social adjustment, being slow learners and missed learning opportunities in the past.

The structure of this article is a follows. Two sections are included in which the setting as well as the education context of the study are described followed by a section in which literature on the relationship between age and achievement is reviewed. After

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that, two sections are included in which the methods and analytical techniques used in this study are described. These are followed by a section in which the results are presented, interpreted and discussed. Finally, a concluding section is included in which the possible implications of the results to policy and practice are discussed.

2. Setting of the study

The study was carried out in six main towns in Kenya. They included Eldoret, Kisumu, Mombasa, Nairobi, Nakuru and Nyeri. Apart from Nairobi, within each of the other towns, the focus site was the largest slum according to the Kenya National Bureau of Statistics (KNBS). In case of Nairobi the study focus site were two slums where health and demographic surveillance system (HDSS) survey is conducted. Contextual information about the slum sites involved in this study is described in the paragraphs that follow.

The largest slum settlement in Eldoret town is Langas. The slum is situated about 10 km from the central business district of Eldoret town. The town is located about 330 km northwest of Nairobi. It is surrounded by a large agricultural area and for this reason it is home to many farmers. Langas slum covers an area of 46.5 km^2 and is occupied by 12,525 households with a population of 28,252 persons (KNBS, 2010). Langas falls under the high density, low-income areas of the Eldoret town (Murage and Ngindu, 2007).

Manyatta 'A' is a slum settlement in Kisumu town. Fishing is the largest economic activity in the town due to the presence of the fresh water Lake Victoria. The slum covers an area measuring 2.4 km^2 with a total of 12,525 households and a population of 48,004 (KNBS, 2010).

Maweni is the largest slum in Mombasa, the second largest city in Kenya, located in the outskirts of the town. The settlement which occupies an area of 6.4 km^2 has a total of 12,742 households with a population of 42,187 people. Mombasa residents derive their livelihoods from a variety of economic activities including formal employment in industries, tourism, and fishing.

In Nairobi two slum sites were targeted, Korogocho and Viwandani. Korogocho occupy an area of 0.9 km^2 and located approximately 11 km from Nairobi's central business district. The informal settlement has 12,909 households (KNBS, 2010). Most residents operate small informal income generating activities as wage employment is difficult to come by. The slum is characterized by high levels of insecurity, poor accessibility, inadequate housing, poor sanitation and water quality, and low access to basic services like health care and education. Viwandani occupy an area measuring 5.7 km^2, and has 17,926 households (KNBS, 2010). It is located within the industrial area part of Nairobi, about 7 km from Nairobi city centre. The informal settlement is characterized by overcrowding, insecurity, poor housing and sanitary conditions, and inadequate social amenities (Ochako et al., 2011).

In Nakuru, Baharini is the largest slum settlement. The town is located 160 km northwest of Nairobi. Nakuru municipality is cosmopolitan and populated by people from all over Kenya and other parts of the world with a sizeable number of Kenyans of Indian origin. The main economic activities are manufacturing and tourism, with agriculture dominating the surrounding areas. Baharini occupies an area of 2.6 km^2. It has a total of 4829 households with a population of 17,078 people (KNBS, 2010).

In Nyeri town, the selected slum site, Majengo, had 8168 households and a population density of 3849 persons per square kilometre (KNBS, 2010). The town is located in the central fertile highlands and is the largest town in Nyeri County, 150 km north of Kenya's capital city, Nairobi. Food and water are plentiful and relatively cheap. Small-scale business activities are vibrant in the town. As an administrative town, the population has a high proportion of government and corporate workers.

3. Education system

The Kenya education system consists of eight years of primary school, four years of secondary and minimum of four years of university education (8-4-4). Some children go through preschool at ages 3–5 but preschool education is not compulsory in Kenya. The official primary school entry age is 6 years. The school year in Kenya starts in January. If all pupils enter school at the official age and there is no grade repetition, the expected average age at the beginning of grade 6 (the time the data for this study were collected) would be around 11½ years. This is because birthdays are spread across a calendar year, meaning that some pupils could have entered school when they had just turned 6 years while others could have entered when they were almost 7 years.

Basic education in Kenya involves preschool education; primary education (grades 1–8) and secondary (form 1 to 4). On completing grade 8, pupils must sit for the Kenya Certificate for Primary Education to progress to secondary.

Late school entry is a common phenomenon especially among low income populations such as slums (Ngware et al., 2008). In Kenya, studies have shown that Free Primary Education (FPE) has provided enrolment opportunities for many older children who had previously been excluded from school (Government of Kenya, 2005; Ngware et al., 2009). Nevertheless, in urban areas, Ngware et al. (2014) found that the FPE policy reduced the probability of late enrolment by 14%. The reduction in probability of late enrolment was greater among children residing in slums (16%) than those in non-slums (9%).

Grade repetition is prohibited in the Kenyan education system. However, it is common for teachers and parents to force pupils to repeat grades contrary to the official policy. Repetition is thought to be common mainly in grades 4, 7 and 8. In case of grade 4, this may be explained by poor adjustment to upper primary schooling that starts at grade 4. In the case of grades 7 and 8 it could be due to high stake exams expected at the end of grade 8 (Keith et al., 2011; Brophy, 2006). In addition, repetition is has been reported as mostly common among urban poor and rural households (UNESCO, 2012). Repetition leads to incidences of over-age pupils as they progress across grades.

4. Literature review

Findings of the effects of relative age on learning achievement suggest that older pupils in class generally outperformed their younger counterparts in developed countries while the opposite is mostly the case in developing countries. Sharp et al. (2009) reviewed 18 studies that examined the effects of relative age on achievement which were carried out in Australia, Chile, the United Kingdom and the USA and published from 2000 to 2008. The most common finding of the studies reviewed by Sharp and her colleagues was that pupils who were older in the grade did better than younger counterparts in almost all subjects including reading, numeracy and writing.

Datar (2006) examining test scores of over 13000 pupils collected at the commencement of preschool and at the end of the first grade in USA showed that pupils who started preschool a year older than their classmates attained better learning scores. Interestingly, Datar's study also showed that the learning scores of the older pupils increased at a faster rate across grade levels than scores of their younger counterparts, meaning that older pupils made more progress than younger pupils. Another American study by Yesil-Dagli (2006) found that older pupils outperformed younger pupils regardless of ethnicity, gender and socio-economic status. Furthermore, another study carried out in the USA found that age was a stronger predictor of reading and mathematics scores than gender or ethnicity (Oshima and Domaleski, 2006).

Some studies have reported that the effects of age on achievement lingers across grades but these effects are less pronounced in upper primary school grades (Lin et al., 2009; Bedard and Dhuey, 2006; Yesil-Dagli, 2006). For example, Bedard and Dhuey (2006) using data involving almost 300,000 pupils from 1995 and 1999 Trends in International Mathematics and Science Study (TIMSS) found that older children scored higher on the grade 4 and grade 8 TIMSS tests and that the age effects at grade 8 were less than at grade 4. However, studies have yielded conflicting information as to what age or grade level are the age effects no longer important. For instance, a study by Perry (2010) reported that age effects disappear completely after grade 4. Yet other studies have shown relative age effects in secondary schools with older students obtaining better test scores than younger students (Moussa, 2012; Cobley et al., 2009).

Nevertheless, findings from some studies have suggested that there is no relationship between age and learning achievement. For example, a study by Cascio and Schanzenbach (2007) investigated the effects of age on test scores using data from Project STAR (Student–Teacher Achievement Ratio) involving over 6000 pupils in 79 schools in Tennessee, USA. The researchers found no evidence that older pupils attain better test scores. Interestingly, they found that younger pupils from poor families were less likely to go to college. They argued that the practice of delayed school entry was also not profitable in improving learning achievement and, if anything, this practice was economically harmful because it could show the acquisition of human capital. In addition, another American study by Linrove and Painter (2006) used data from the National Education Longitudinal Survey to show that late school entry does not create any long-term advantages for pupils. This study, which involved following 25,000 grade 8 students through high school and college, concluded that the performance of younger students was roughly the same as that of older students.

On the contrary, most studies carried out in developing countries (especially in Africa) have reported younger pupils outperforming older pupils in most school subjects including literacy and numeracy. For example, a study by Kunje et al. (2009) analyzed test data from 6000 grade 7 pupils in Malawi found that the test scores of younger pupils were consistently better than those of older pupils in English literacy, mathematics and Chichewa (a local language). In the 2002 SACMEQ study, younger pupils were estimated to significantly outperform older pupils in reading literacy in 12 out of the 14 countries in the SACMEQ II Project. In addition, pupil age was found to be a key factor affecting pupil achievement in five SACMEQ countries (Hungi and Thuku, 2010b). Results from the SACMEQ III Project which involved 15 countries in 2007, also showed younger pupils outperforming older pupils in 12 and 9 countries in reading and mathematics, respectively (Hungi, 2011). Moreover, a study by Keith et al. (2011) analyzing data from national examination involving over 740,000 pupils, showed that older pupils performed much lower than younger pupils in the 2010 Kenya Certificate of Primary Education (KCPE) examination.

5. The data and methods

This section covers the sampling procedures, data collection, survey tools and a description of the variables of interest in this paper.

5.1. Sampling procedures and sample size

This study used cross-sectional data involving schools serving communities living in purposively selected slum sites in six major towns (Eldoret, Kisumu, Mombasa, Nairobi, Nakuru and Nyeri) in Kenya. The selection of a town was guided by presence of slum settlement in the town as well as the administrative and economic importance of the town in the county. Except in Nairobi where two slums were purposively selected because of their involvement in HDSS survey, the largest slum in each of the other towns was selected for involvement in this study. Slums were targeted because of high incidences of poverty among slum dwellers and likelihoods of getting over-age pupils in slums (Ngware et al., 2014).

A school was included in the sample if it was likely to be accessed by children from the slum and had a grade 6 class. In this regard, all schools that had a grade 6 class and were in the selected slum or within the slum's catchment area (one kilometre radius from the slum) were selected. All grade 6 pupils in the selected schools were included in the sample. In cases where a school had two or more grade 6 streams, only one stream was selected at random. The final sample involved in this study consisted of 7041 grade 6 pupils in 226 schools.

5.2. Data collection

A total of 139 field enumerators were involved in data collection in this study. Prior to data collection, the enumerators were trained on the survey tools and the best practices as well as ethical protocols during data collection. In addition, as part of their training, the enumerators were exposed to hands on experience in the use of the survey tools and procedures through role plays and a pre-test of the tools. The pre-test of the tools was carried out in schools not involved in this study. All the enumerators were involved in the pre-test. Debriefing sessions were held after the pre-test to ensure that the all the enumerators had common understanding of the tools and the procedures. By the end of the training, all the enumerators were fluent in administration of the tools and were well prepared to collect data of highest quality.

The actual data collection was conducted in January and February, 2012. A team of three enumerators led by a team leader worked in one school for two days. Throughout data collection, the team leaders were required to maintain regular communication with the principal researchers. In addition, several measures were taken to ensure that quality data were collected. For example, before leaving the school, all team members were required to check and correct their work after which they were required to submit the completed instruments to their respective team leaders. On their part, the team leaders were required to re-check all the instruments for errors and inconsistencies. If team leaders found doubtful information while re-checking, they were required to go back to the school to confirm the information with the person who responded to the questionnaire. In addition, the core research team did spot checks in some schools to ensure that all was well with data collection and that quality data were collected.

5.3. Ethical issues

In line with ethical practices, stringent procedures to uphold the fundamental principles governing research on human subjects were followed during this study. For instance, all the key investigators involved were required to have undertaken a research ethics course. In addition, full disclosure regarding the purpose of the study and the procedures were given to the key people involved in the study including the pupils and head teachers. Furthermore, before commencing the study, ethical approval was obtained from relevant authorities in Kenya.

During data collection, consent was sought from the pupils while signed informed proxy consents were sought from the head teachers. In this case, the head teachers gave written statements that they are authorized to sign letters of consent on behalf of the parents – this is the standard and is acceptable in Kenya. For

interviews with head teachers, signed informed consents were sought from them. Participation in the study was voluntary and participants were not be coerced to participate, even when the head teacher gave consents, pupils were voluntarily required to participate. The interviews were conducted in privacy and confidentiality was upheld.

5.4. Survey tools

Brief descriptions of the main survey tools involved in this study are given in this subsection.

5.4.1. Questionnaires

Questionnaires were used to collect information about pupils and schools in this study. In this regard, a pupil questionnaire was administered to all grade 6 pupils in the sample. This questionnaire captured background information about the pupils such as their age, sex and incidences of grade repetition. A parents' questionnaire capturing information about home possession and parental education was administered to all parents of grade 6 pupils involved in this study. A school questionnaire was administered to all head teachers (or their deputies) of the schools in the sample. This questionnaire collected data about school ownership and enrolment among other information. Apart from the parents' questionnaire which was in local language (Kiswahili) all the other questionnaires were in English. All questionnaires were administered in their original languages and no translation was done.

5.4.2. Assessment tool

The literacy test was developed after curriculum mapping by subject specialists to identify the important skills in literacy which were to be assessed at grade 6. This skills included listening, reading comprehension and creative writing. During the process of test development, it was field-tested and refined to ensure that all the items in the final test had sound psychometric characteristics and that they conformed to the national syllabus. After administration of the test, the individual pupils were scored on different items.

5.5. Variables of interest

The main variables of interest in this paper are pupil score (expressed as a percentage) in a literacy test, and pupil age at grade 6.

5.5.1. Pupil score

Referred to the total score achieved by a pupil in the grade 6 test. Each item in the test responded correctly was award one score. Thereafter, the raw score was converted into percentage. These are the literacy scores that have been used as the outcome variable in this article.

5.5.2. Pupil age

Age was the main explanatory variable, and referred to the chronological age of the pupil. Data on pupil age at grade 6 were calculated from information on the pupil date of birth and the date of interview. The resulting pupil age data were rounded to the nearest whole year to construct pupil age categories. These age categories were then used to construct the dummy variables for pupil age that have been used in this article. Seven dummy variables (to be called AGE10–AGE16) were constructed to denote pupils in the 10-years age category to pupils in the 16-years age category, respectively. In coding of the data a "1" was used to indicate data of pupils of that particular age category and a "0" was used to indicate data of pupils from the other six age groups. Perhaps it is worth noting that a few (43) pupils were above 16 years and these pupils were put in the 16-years age category.

At least two things are worth noting while interpreting the age categories used in this study. First, because age data were rounded to the nearest whole year, this means that, for example, pupils who were as young as 10 years 6 months (10½ years) and up to those who were as old as 11 years 5 months were put in the same age category, 11-years age category. Similarly, 12-years age category consists of pupils who were 11 years 6-month old up to those who were 12 years 5 months.

Second, at earlier stages of this study, other methods of grouping pupil age data were explored but were discarded because of one reason or another. In this regard, a method of grouping together pupils who had turned a particular age before grade 6 started (for example, grouping together those who turned 11 before the grade 6 year started, as they would have turned 6 before grade 1 started) was explored. However, this method was not pursued because, from the results, it was not clear which is the optimal age category. In addition, a method of grouping together pupils in 6-month categories (that is, 10 years, 10½ years, 11 year, 11½ years, and so on) was explored but not followed because the results using these categories were considered unstable. This is because, using this grouping approach, some age categories had only a few cases for meaningful analysis.

5.5.3. Grade repetition

Apart from pupil score and pupil age, the other variable that was considered crucial in this study was grade repetition because it is one of the factors that contribute to the age of the pupil at a particular grade – the other factor being the age at which the pupil started schooling. The sampled pupils were asked how many times they had repeated a grade since they started school, including grade 6. For purposes of this article, if the pupils said that they had "never repeated" grade repetition was coded "0". If the pupils indicated that they had repeated at least once, grade repetition was coded "1".

5.5.4. Other variables

Pupil wealth background, pupil sex and school type (public or private) were the other variables that attracted interest in this study mainly because these variables have been identified as key predictors of pupil achievement at the grade 6 level in Kenya in several studies (see for example Ngware et al., 2012; Hungi and Thuku, 2010a,b). A summary of the variables of interest in this study has been provided in Table A1 in Appendix. A summary of the number of pupils involved in this study by the variables of interest (that is, age, sex, grade repetition and wealth background) as well as by geographical location (counties) can be found in Tables A2 and A3 in Appendix, respectively. Pupil wealth background index was constructed from ownership of a range of durable household items such as house, car, television, refrigerator and telephone among others using principal component analysis (PCA) technique.

6. Hypothesized models

In this study, descriptive statistics were used to examine the distribution of grade 6 pupils' age. Descriptive statistics were also used to examine incidences of over-age pupils and incidences of grade repetition across various subgroups of pupils disaggregated by factors such as sex, wealth background, grade repetition, school type and geographical location. Multilevel techniques were employed to examine the relationship between age and literacy achievement taking into account the key pupil and school characteristics.

Section 6.1 describes the multilevel models used to compare literacy scores across age categories. These are the models that were used to estimate the impact of age on literacy achievement. In Section 6.2, the models used to examine the relationship between pupil age and literacy achievement across subgroups of pupils are described.

6.1. Hypothesized models for estimating the impact of age on literacy achievement

Using HLM, only a maximum of six dummy variables denoting pupil age categories can be included in an analysis simultaneously, leaving the seventh variable as a reference point upon which the other age categories are compared. In this study, seven models were run; each model with one of the seven age categories used as the comparison group. This means that the dummy variable denoting the comparison age category was not included in the analysis. For example, in the model in which the 10-years age category was used as the comparison group (to be called Model 10), the dummy variable AGE10 was excluded in the analyses but all the other six dummy variables (AGE11–AGE16) were included in this analysis. This model is referred to as "Model 10" to indicate that the 10-years age category is the comparison group. Similarly, the model in which 11-years age category is the comparison group is referred to as "Model 11", and so on.

In equation format and following the notations used by Raudenbush and Bryk (2002), Model 10 can be described as follows.

Level-1 model

$$\begin{aligned} Y_{ij} = {} & \beta_{0j} + \beta_{1j}(\text{SEX})_{ij} + \beta_{2j}(\text{REPEAT})_{ij} + \beta_{3j}(\text{WEALTH})_{ij} \\ & + \beta_{4j}(\text{AGE11})_{ij} + \beta_{5j}(\text{AGE12})_{ij} + \beta_{6j}(\text{AGE13})_{ij} \\ & + \beta_{7j}(\text{AGE14})_{ij} + \beta_{8j}(\text{AGE15})_{ij} + \beta_{9j}(\text{AGE16})_{ij} + r_{ij} \end{aligned}$$

Level-2 model

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{SCHTYPE})_j + u_{0j} \\ \beta_{1j} &= \gamma_{10} \\ \beta_{2j} &= \gamma_{20} \\ &\vdots \\ \beta_{9j} &= \gamma_{90} \end{aligned} \tag{1}$$

where Y_{ij} is the literacy score of pupil i in school j; β_{0j} is the mean score of school j; β_{1j}, β_{2j} and β_{3j} are the regression coefficients associated with school j for pupil sex, grade repetition and wealth background, respectively; β_{4j}, β_{5j}, β_{6j} ... β_{9j} are the regression coefficients associated with school j for Age 11, Age 12, ... and Age 16, respectively. Positive coefficient associated with a particular age indicates that pupils of that age category performed better in literacy than the comparison group, while negative coefficient indicates the opposite; r_{ij} is a random error or "pupil effect", that is, the deviation of the pupil mean from the school mean; γ_{00} is the grand mean (that is, the overall mean of the sampled schools); γ_{01} is the regression coefficients associated with the type of school; u_{0j} is a random "school effect", that is, the deviation of the school mean from the grand mean.

The indices i and j denote pupils and schools where there are $i = 1, 2, \ldots, n_j$ pupils in school j; and $j = 1, 2, \ldots, J$ schools (in this study $J = 226$).

In simple terms, Eq. (1) shows that at Level-1, the pupil score is modelled as a function of a school mean, pupil sex, grade repetition, wealth background, pupil age and a random error, and at Level-2, the pupil score is modelled as a function of a grand mean and school type.

The equations for Models 11 to 16 are similar to the equation for Model 10 (i.e. Eq. (1)). However, Model-11 for example, has the variable AGE10 instead of the variable AGE11.

6.2. Hypothesized models for examining the relationship between age and literacy achievement across subgroup of pupils

This study also aimed at examining the relationship between pupil age and literacy achievement for selected subgroups of grade 6 pupils so as to find out if this relationship was different (or similar) for different subgroups of pupils. In order to achieve this aim, separate models were run using data from different subgroups of pupils disaggregated by sex, grade repetition, wealth background, school type and geographical location as described below.

(a) *Pupil sex models*: Two models were run by subdividing the data by pupil sex; one model using data from boys only (to be called Boys Model) and the model using data from girls only (to be called Girls Model). The number of cases involved in the Boys and Girls Models were 3449 and 3592, respectively. The aim of these models was to find out if the relationship between age and literacy achievement among boys was the same as among girls.
(b) *Grade repetition models*: Similarly, two models were run for grade repetition; one involving pupils who had never repeated a grade (Non-Repeaters Model, $N = 4760$) and the other involving pupil who had repeated a grade a least once since they starting schooling at grade 1 (Repeater Model, $N = 2281$). The aim here was to find out if the relationship between age and literacy achievement is influenced by grade repetition.
(c) *Wealth background models*: Two models were run – one for pupils in the poorest wealth category (Bottom 25% Model, $N = 2320$) and the other for pupils in the least poor wealth category (Top 25% Model, $N = 2360$). Thus, the Bottom 25% Model involve the poorest pupils but disaggregated by age and the Top 25% Model involve the least poor pupils but disaggregated by age.
(d) *Type of school models*: Two models were run, namely Public (Government) School ($N = 4196$) and Private (Non-Government) School ($N = 2845$) Models for pupils attending public and private schools, respectively. The main aim here was to find out if the type of school has an influence on the relationship between pupil age and literacy achievement.
(e) *Geographical location models*: Six models were run; one model for each of the six counties (Eldoret, Kisumu, Mombasa, Nairobi, Nakuru and Nyeri). The research question here was: Do older pupils achieve higher in all counties or vice versa?

In equation format, all the models described in the above paragraphs (a–e) are similar to Eq. (1) but excluding the variable used to subdivide the data. This means that, for example, in the Boys and Girls Models, the variable SEX was excluded but all the other variables in Eq. (1) were included in these two models. Similarly, the variable REPEAT was excluded in the Non-Repeaters and Repeaters Models, the variable WEALTH was excluded in the wealth background models, while the variable SCHTYPE was exclude in the school type models. However, it should be noted that all the variables in Eq. (1) were included in the geographical location models.

7. Results and discussions

There are four sub-sections included in this section. Section 7.1 presents the distribution of pupil age across various subgroups disaggregated by pupil sex, pupil wealth background, type of school (public versus private) and school geographical location.

The second Section 7.2 examines incidences of grade repetition across pupil age categories and across selected pupil and school background factors.

The Section 7.3 presents the multivariate analyses carried out to examine the age that has the greatest positive impact on pupil literacy achievement after controlling for pupil sex, wealth background, grade repetition and type of school. The final subsection investigates the relationship between age and literacy scores across subgroups of pupils using multilevel analyses.

7.1. Distribution of pupil age

As mentioned in the introductory section, the school year in Kenya starts in January and the data for this study were collected in January and February. This means that the data for this study were collected when the pupils were starting their grade 6, when they were about 11½ years on average. Because learners' ages in this study were rounded to the nearest whole years, this means that the average pupil was expected to be in the 12-years age category. It also means that the youngest grade 6 pupils (those who entered school when they had just turned 6 years) were expected to be in the 11-years age category while the oldest grade 6 pupils (those who entered school when they were almost 7 years old) were expected to be in the 12-years age category. Thus, 11 years and 12 years were the expected minimum and maximum age categories for grade 6 pupils in this study, respectively.

The distributions of pupil age by sex are shown in Fig. 1. The results show that slightly over one-third (37%) of grade 6 pupils were in the expected average age category, 12 years; that is, around 38% for both boys and 37% for girls. Regardless of pupil sex, there were substantial percentages of pupils who were below the expected minimum age category (11 years) or above the expected maximum age category (12 years). For the pupils below the 11-years category, this implies that they entered school when they were younger than 6 years or even younger than 5 years 6 months. For the pupils above the 12-years category, this implies that they entered school when they were older than 7 years or that these pupils had repeated grades.

The results also show that, below the 12-years category, there were proportionally more girls than boys while the opposite was the case above the 12-years category. The Gender Parity Index (GPI) at the 12-years category was 100; implying equal number of boys and girls at this age category are in grade 6 (see Fig. 2). Below the 12-years category, the GPIs were above 100 (implying more girls than boys) while, above the 12-years category, the GPIs were below 100 (implying more boys than girls). This seem to suggest that there were more girls than boys entering school below the official school entry age or that more boys than girls were involved in grade repetition.

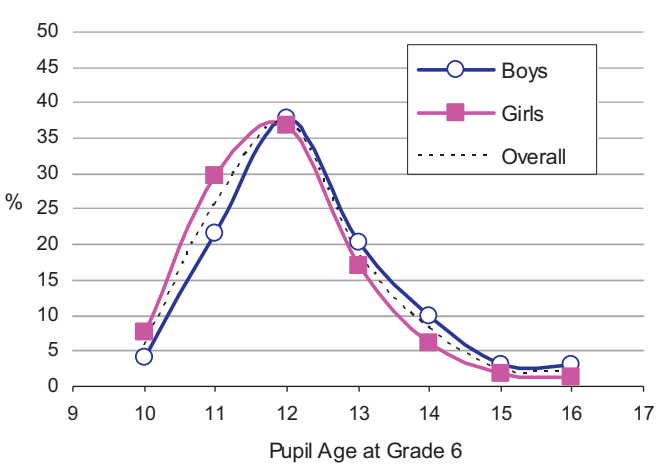

Fig. 1. Distribution of pupil age by sex.

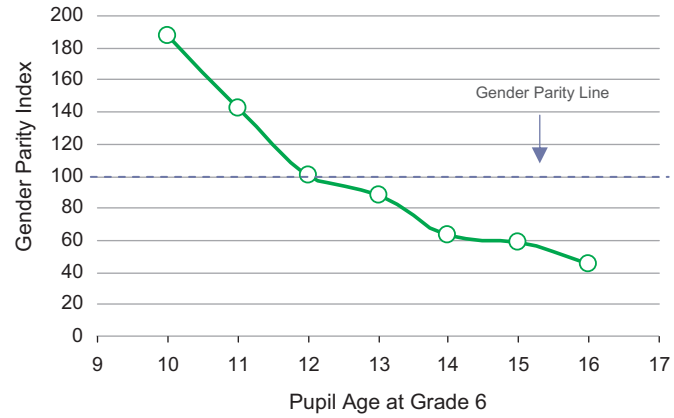

Fig. 2. Gender parity index by pupil age.

For purposes of this study, "over-age" pupils are defined as those that were above the expected maximum age category, that is, above the 12-years age category. On average, 31% of the sampled pupils were above the 12-years category, and thus, over-age for grade 6. However, there were considerable variations in percentages of over-age pupils across gender groups, wealth backgrounds, school types and geographical locations (counties) as shown in Fig. 3. The counties with the highest proportion of over-age pupils were Mombasa (39%) and Kisumu (35%) while the counties with the lowest proportion were Nyeri (24%) and Nakuru (26%). The largest proportions of the over-age pupils were from the poorest wealth category (39%) and public schools (35%). The percentage of over-age boys (36%) was much higher than the corresponding percentage for girls (26%).

7.2. Incidences of grade repetition

The distributions of pupil age by grade repetition are shown in Fig. 4 while the proportions of grade repeaters by age are shown in Fig. 5. As per expectation, there were higher proportions of grade repeaters among the older pupils than among the younger pupils. Importantly, the results in Fig. 4 show that some pupils who said they had not repeated a grade were actually over-age (over 12 years) for grade 6, which indicates that they must have started schooling when they were more than 7 years old. The results in Fig. 5 show that the proportion of grade repeater was smallest among pupils in the 11-years age category. Interestingly, the proportion of grade repeater among the pupils in the 11-years age category was even smaller than among pupils in younger age category (that is, 10 years) and this was regardless of pupil sex or wealth background. It could be that the pupils in the 10-years age category entered school too early, unable to cope with curriculum cognitive demands and hence repeated.

The percentages of pupils who said that they had repeated a grade at least once since they started grade 1 are shown in Fig. 6. On overall, 32% of the sampled pupils said they had repeated a grade at least once. Grade repetition for boys (33%) was marginally higher than that of girls (31%). The grade repetition situation appeared worst among pupils in the poorest wealth category (40%) when compared to pupils from the top wealth category (25%). There was little difference between grade repetition rates among pupils in public and private schools. Across the counties, Nyeri with 40% recorded the highest grade repetition rate followed by Nairobi (38%), while Nakuru with 26% recorded the lowest rate. The high rate for Nyeri was somewhat surprising because it is the county that also recorded lowest level of over-age pupils (Fig. 3). A

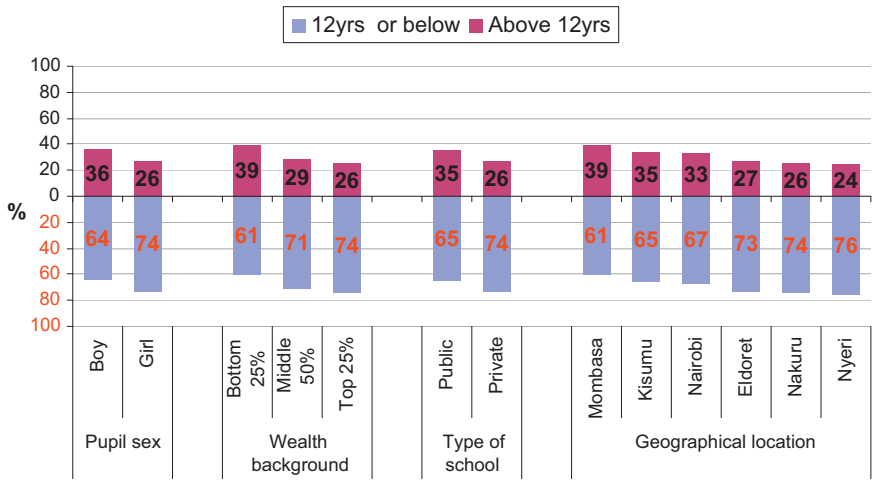

Fig. 3. Percentages of over-age pupils by sex, wealth background, school type and geographical location.

plausible explanation for this could be that many parents in Nyeri County might have enrolled their children in school before they reach the official entry age. It is likely that most of such underage children struggled to cope with schooling and thus have to repeat. It is also likely that the Nyeri results are unstable because of the small sample size ($N = 338$) involved in this county.

7.3. The impact of age on literacy achievement at grade 6

The results from the seven models (Models 10–16) employed to examine the impact of pupil age on literacy achievement are depicted in Figs. 7–13. Each of these figures shows how the mean literacy score of a particular age category of pupils compared with mean literacy scores of pupils of other age categories after controlling for pupil sex, wealth background, grade repetition and school type. More detailed results from these models can be found in Table A4 in Appendix. Interpretations of the results from these models are presented in the paragraphs that follow.

Model 10: The results show that, on one hand, pupils in the 10-years age category achieved significantly lower in literacy than their counterparts in the 11-years age category (see Fig. 7). On the other hand, the results show that pupils in the 10-years age category achieved significantly higher than their older counterparts who were in the 13-years age category or above. In addition, the results show that pupils in the 10-years age category slightly outperformed pupils in the 12-years age category but this was not statistically significant at $p \leq 0.05$.

Model 11: Results from this model indicate that pupils in the 11-years age category achieved significantly better in literacy than their younger counterparts (10-years category) as well as their older counterparts (12- to 16-years categories) (Fig. 8).

Model 12: The results in Fig. 9 show that pupils in the 12-years age category achieved significantly better in literacy than all their older counterparts but they were outperformed by their younger counterparts, and significantly so by pupils in the 11-years age category.

Comparison of literacy scores across pupil age categories

Model 13: Fig. 10 shows that pupils in the 13-years age category were significantly outperformed by younger pupils (10- and 11-years age categories) but they significantly outperformed older pupils (14- to 16-years age categories).

Models 14–16: The results in Figs. 11–13 indicate that pupils in the 14-, 15- or 16-years age categories achieved significantly poorer in literacy than all their younger counterparts. These results also show that there were no much differences in literacy performance between pupils in the 14- to 16-years age categories.

Thus, from the above results, it is evident that 11 years is the age category that had the greatest positive impact of literacy

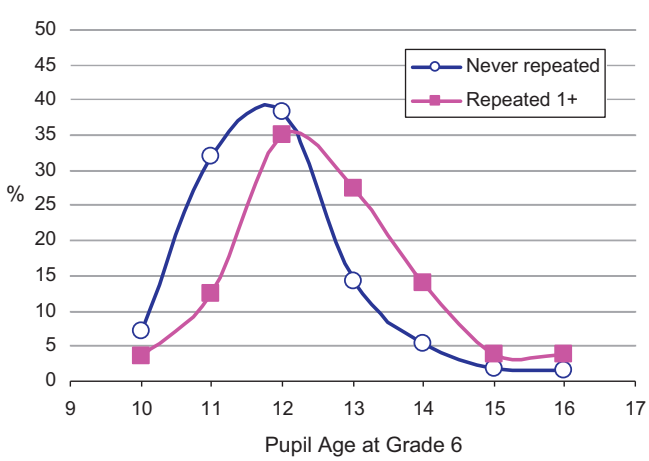

Fig. 4. Distribution of pupil age by grade repetition.

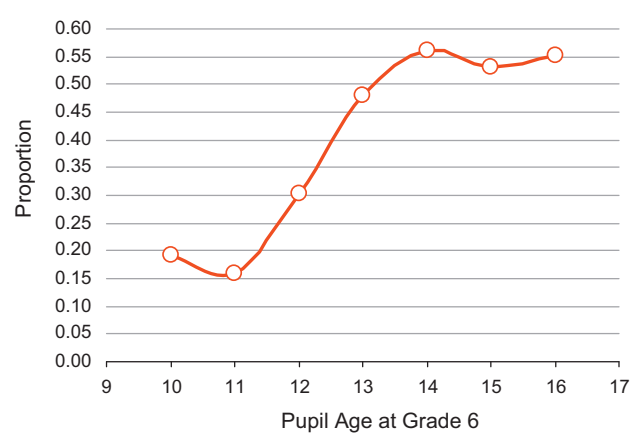

Fig. 5. Proportion of grade repeaters by age.

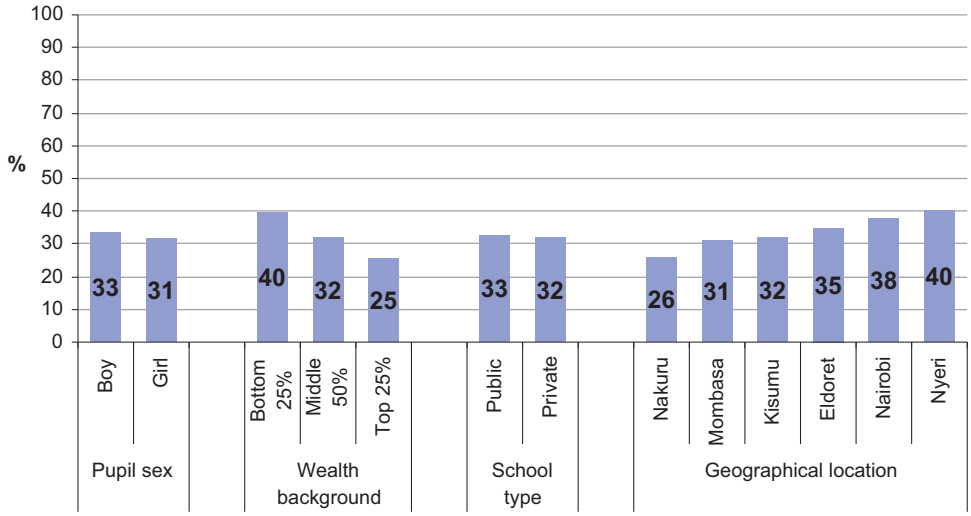

Fig. 6. Percentages of pupils repeating grades at least once across selected sub-groups.

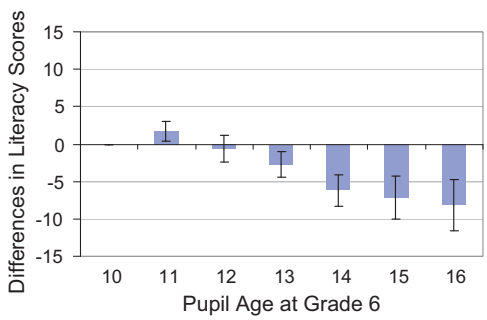

Fig. 7. Model 10: comparison group = Age 10.

achievement at grade 6 assuming all other factors are held constant. More specifically, because age data were rounded to the nearest whole age in this study, the age bracket that had greatest impact on literacy scores at grade 6 was 10 years 6 months to 11 years 5 months. Assuming no grade repetition, grade 6 pupils in the 11-years age category are those who started schooling when they were at least 5½ years old and at most 6 years 5 months old.

It is worth noting that, for purposes of making the results clearer and thus easier to interpret, seven different models were estimated using different age categories as reference points (Models 10–16). However, it is possible to reach the same conclusions given above by running just one of these models.

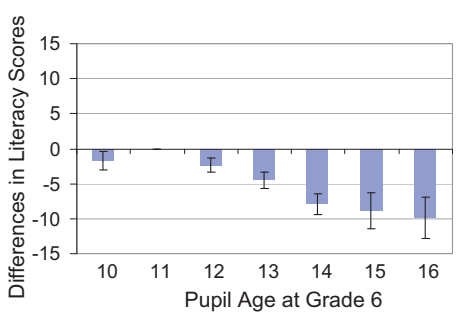

Fig. 8. Model 11: comparison group = Age 11.

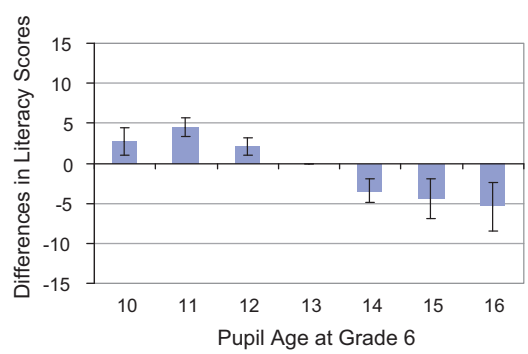

Fig. 10. Model 13: comparison group = Age 13.

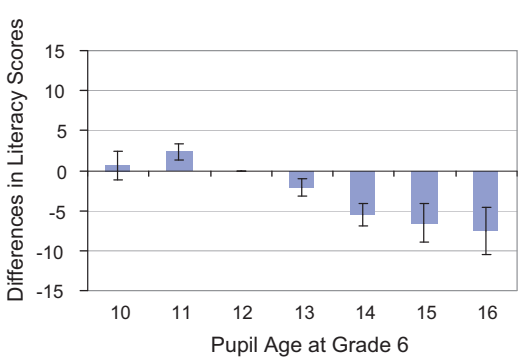

Fig. 9. Model 12: comparison group = Age 12.

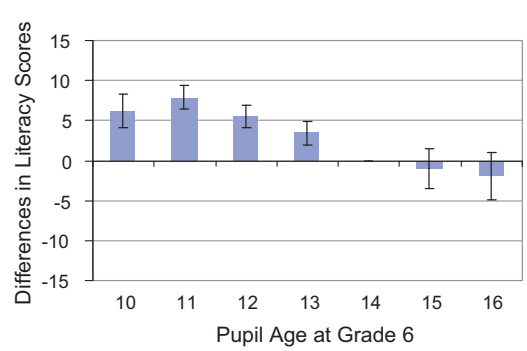

Fig. 11. Model 14: comparison group = Age 14.

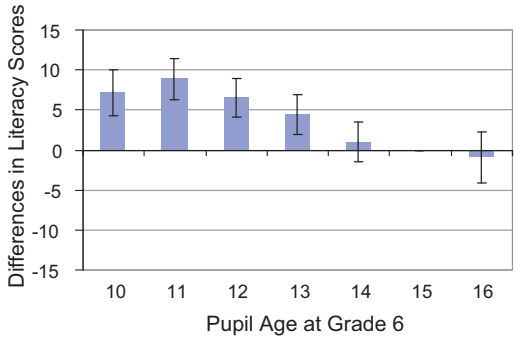

Fig. 12. Model 15: comparison group = Age 15.

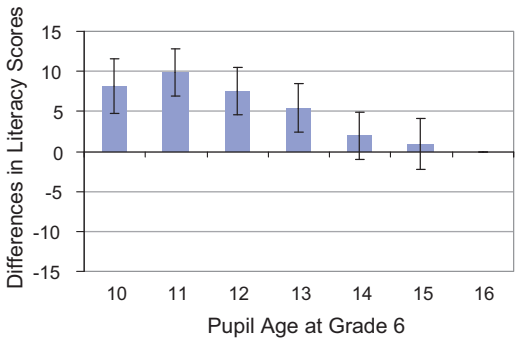

Fig. 13. Model 16: comparison group = Age 16+.

7.4. The relationship between age and literacy achievement across subgroups of pupils

Figs. 14–18 show the distribution of literacy scores by age across various background factors. Each curve in these figures was plotted using results from a multilevel model involving only data from the mentioned group of pupils. For example, in Fig. 14, the "Boys" curve was plotted from results of the Boys Model (that is, a model involving boys only, $N = 3449$), while the "Girls" curve was plotted from results of the Girls Model (that is, a model involving girls only, $N = 3592$).

Fig. 7 Mean literacy scores by age categories across various backgrounds.

Likewise, the "Never repeated" and "Repeated 1+" curves in Fig. 15 were plotted from results of the Non-Repeaters Model ($N = 4760$) and Repeaters Model ($N = 2281$), respectively. The results used to plot these curves can be found in Table A5 in Appendix. It should be noted that, in the multilevel models used to generate these results, literacy scores were adjusted to cater for

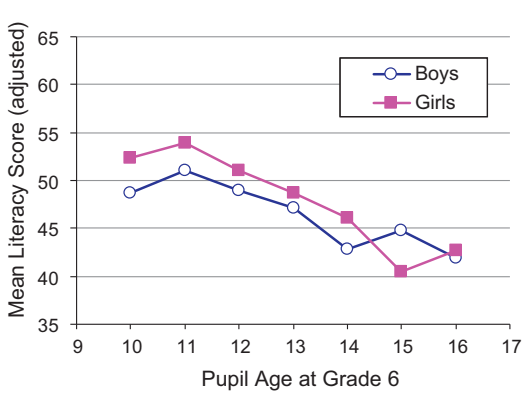

Fig. 14. Pupil sex.

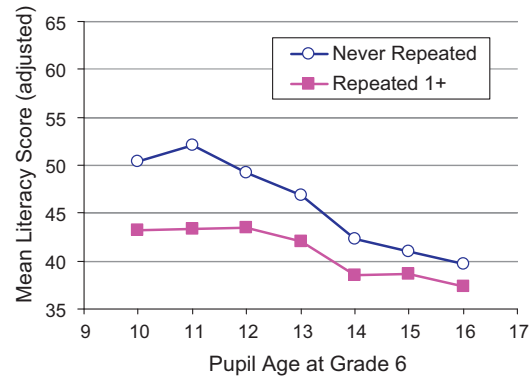

Fig. 15. Grade repetition.

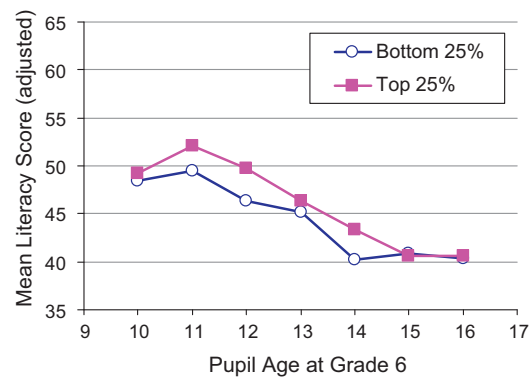

Fig. 16. Wealth background.

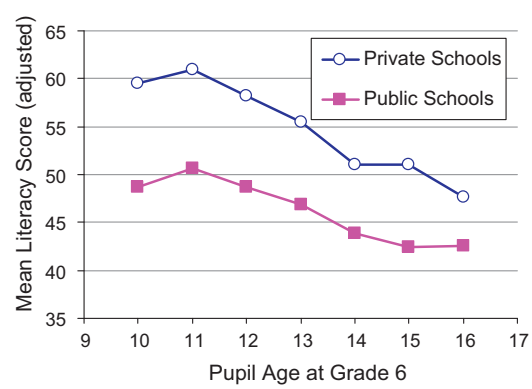

Fig. 17. School type.

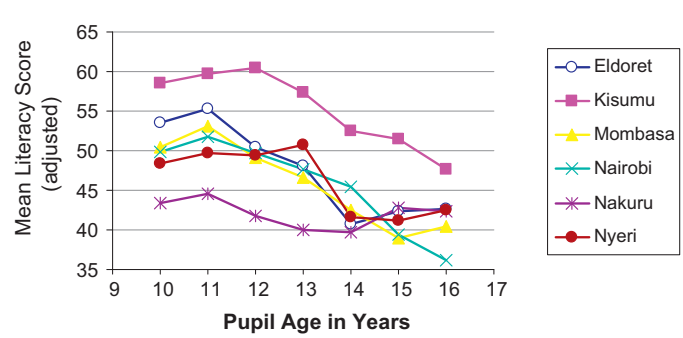

Fig. 18. Geographical location.

differences in the other pupil characteristics that were not the focus in that model. For example, in pupil sex models (that is, Boys and Girls Models), the scores were adjustment for grade repetition, wealth background and type of school attended. Likewise, in the grade repetition models, adjustments were made for pupil sex, wealth background and type of school. In the geographical location models, adjustments were made for pupil sex, grade repetition, wealth background and school type.

The results in Figs. 14–18 show that, in general, younger pupils were likely to achieve better than older pupil in literacy regardless of the background under consideration. Importantly, in almost all the backgrounds considered, grade 6 pupils in the 11-years age category were estimated to perform better than pupils of other age categories, which is consistent with the results from Models 10 to 16 above. Therefore, 11 years is the age category that had the greatest positive impact on literacy scores regardless of pupil sex, grade repetition, wealth background, school type or geographical location. The expected average age category at start of grade 6 is 12 years; given the official age at primary school entry is 6 years and age data in this study were rounded to the nearest whole year.

It is also interesting to note from the results in Fig. 15 that, among grade 6 pupils, the differences in literacy achievement between non-grade repeaters and repeaters tend to decline with age. Likewise, it is interesting to note from the results in Fig. 16 that, among older grade 6 pupils (those above the 14-years age category), the literacy achievement of pupils from poorest wealth backgrounds was roughly the same as that of pupils from less poor wealth backgrounds. When interpreting the results in Fig. 16, it is important to note that the data were collected in slums – where almost all household are extremely poor. Therefore, variation in the wealth index used in this study was minimal.

For repeaters, there were no statistically significant differences between the scores of pupils in the 10- to 13-year age categories (result in Table A5 in Appendix). In addition, for most subgroups, there were no statistically significant differences between score of pupils in the 10 and 11-years age categories – although the scores for pupils in the 11-years category were better than those of pupils for all subgroups. Similarly, for Nyeri, there were no significant differences between the scores of pupils in 11-years category and those of pupils in most of the other age categories (results in Table A6 in Appendix).

8. Summary and conclusions

This paper employed descriptive and multilevel analytical techniques to investigate the age category at which primary school pupils from poor home backgrounds perform their best in literacy at grade 6 level in Kenya. In almost all the backgrounds considered in this study, grade 6 pupils in the 11-years age category (that is, pupils in the age range 10 years 6 months to 11 years 5 months) were estimated to perform better than pupils in other age categories. In general, younger pupils were likely to achieve better than older pupil in literacy regardless of the background under consideration.

Apart from the above, the study found that, on overall, 31% of the sampled pupils were over-age (that is, above the 12 – years age category – which was the expected maximum age category for grade 6 at the time the data for this study were collected). Incidences of over-age pupils were found to be more common among boys (36%), pupil from poorest home background (39%), those attending public schools (35%) and among pupils in Mombasa (39%).

In terms of grade repetition, 32% of the sampled pupils were found to have repeated a grade at least once since starting schooling in grade 1. Incidences of grade repetition were found to be about the same among boys and girls also about the same among pupils attending public schools and private. However, such incidences were more common among pupils from the poorest families than among pupils from less poor families. Interestingly, it was found that incidences of grade repetition were less common among pupils in the 11-years age category than among pupils in younger age category (10 years) or older age categories (12–16 years).

8.1. What are the implications of these findings?

Being below or above the 11-years category at grade 6 was a clear disadvantage in terms of literacy achievement across all the backgrounds considered in this study. Being below or above the 11-years category was also a disadvantage in terms of grade repetition.

First, these findings have both short-term and long-term implications for school-age entry policy. In the short-term and if immediate policy change cannot be entertained without additional evidence from other data sets, policy should concentrate on ensuring that children start schooling at the current official age of entry, which is 6 years old. The education authorities could encourage this by sensitizing parents (especially among low income communities) on the negative effects associated with early or late school entry. The authorities could also achieve this by reinforcing the current school-age entry policy which stipulates that children should enter grade 1 in January if they turn 6 by 31st of December of the previous year. In the short-term, reinforcing this policy alongside the EFA policy could prove to be tricky because there are still considerable numbers of school-age children in Kenya who are yet to enter school, especially from poor families (Uwezo, 2011).

Some parents in Kenya enrol their children before the official school entry age with a hope that, if the children do not do well, they can always repeat because they have a year or two to spare compared to their classmates. Parents need to be made aware that repetition does not offer the same advantage as entering school at the official school entry age (also see Dougan and Pijanowski, 2011). Furthermore, as shown in this study, repetition has negative effects on achievement regardless of the pupil age.

In the long-term, the authorities could consider modifying the current school-age entry policy to specify that children should enter grade 1 in January if they turn 5½ by 31st of December of the previous year. This is because children who enter school at 5½ years would be in the age category that has been linked with the best test scores in this study (11 years), assuming no grade repetition. In this regard, perhaps the authorities in Kenya could learn from other countries (for example Seychelles and Mauritius) in the region which have shown impressive performances in SACMEQ studies yet they have school-age entry policies of below 6 years (Leste and Benstrong, 2011; Sauba and Lutchmiah, 2011). In the SACMEQ III study (2007) which targeted grade 6 pupils in 15 African countries, both Seychelles and Mauritius (both with school-age entry policy of 5½ years) were ranked better in reading literacy than Kenya (with school age policy of 6 years). Seychelles and Mauritius were ranked 2nd and 3rd, respectively, while Kenya was ranked 5th out of the 15 SACMEQ countries in reading literacy (Hungi et al., 2010).

Second, these findings imply that pupils of different ages should be handled differently if the learning barriers associated with age are to be minimized. Sharp et al. (2009) suggest that, apart from affecting pupil-to-pupil relationships, being older or younger in class could significantly influence how teachers interact with the pupil especially in terms of the feedback the teachers give to the pupil, discouragement of negative behaviour and reinforcement of positive behaviour. Thus, these findings have potential implications for how over-age or underage pupils who are already in the

system should be handled in classrooms. Just like it is inappropriate to stereotype pupils because of their sex, education policy should spell out that it is also inappropriate to stereotype pupils because of their age. Teaching and learning materials and as well as teaching strategies and curriculum content should also be age sensitive.

Third, because grade repetition was associated with lower literacy scores regardless of pupil age, these findings imply that incidences of grade repetition in the system should be reduced or eliminated altogether. Again, the education authorities could achieve this by reinforcing the existing no-repetition policy. The education authorities would need to work closely with community leaders such as local chiefs and religious leaders if they are to succeed in this mission. Having said this, it would still be important for the authorities to sensitize both parents and teachers on the problems associated with grade repetitions because these are the people on the ground who make the final decisions regarding repetition. Apart from the obvious effect of grade repetition of making pupils over-age for their grade, it is possible that lack of progression disheartens the repeating pupils making them disinterested in learning. Brophy (2006) identified some alternative strategies that could be used to assist pupils at risk of grade repetition including early intervention, working with parents and individualized supplementary instructions.

Finally, these findings have implications for further studies. This study provided evidence regarding the age category at which grade 6 pupils perform their best in literacy. However, the study is based on slum contexts where incidences of poverty are overwhelmingly common and social (and probably classroom) interactions are most likely different from those in other settings in Kenya. The contexts by themselves could have affected the results in a way that might not be obviously clear. Thus, it might be interesting to replicate the study using data from non-slum sites. Moreover, this study is based on cross-sectional data from one grade level, meaning it is not possible to estimate the performance of pupils across grades using this data. It is possible that the age-versus-achievement relationship differs across primary school grade levels. Thus, it might be interesting to repeat this study using cross-sectional data from several grade levels. Even more interesting would be a longitudinal study that would allow the performance of individual child to be followed across the grades and that would include teacher-level data to allow for estimation of the impact of interaction effects between pupil age and teacher-related factors on achievement. Such longitudinal data would provide a better understanding of the age-versus-achievement relationship as well as the effects of age in general as a potential learning barrier in Kenya and in developing countries.

Acknowledgement

This study was funded by William and Flora Hewlett Foundation (grant no. 2011-6693).

Appendix

See Tables A1–A6.

Table A1
Variables of interest in this study.

Symbol	Symbol denotes	Variable description
SCORE	Literacy score (mean = 52.6; Std. Dev. = 19.6; range 0–97%)	Pupil literacy score
SEX	Pupil sex (0 = boy; 1 = girl)	Female pupil
REPEAT	Grade repetition (0 = Never repeated; 1 = Repeated 1+)	Pupil has repeated a grade at least once
WEALTH	Wealth background (1 = bottom 25%; 2 = middle 50%; 3 = top 25%)	Pupil wealth background
SCHTYPE	School type (0 = public school; 1 = private school)	Pupil attends a private school
AGE10	Dummy for Age 10 (1 = age 10; 0 = all other ages)	Pupil is in the 10-years age category (age range: 10 years 5 months or below)
AGE11	Dummy for Age 11 (1 = age 11; 0 = all other ages)	Pupil is in the 11-years age category (age range: 10 years 6 months to 11 years 5 months)
AGE12	Dummy for Age 12 (1 = age 12; 0 = all other ages)	Pupil is in the 12-years age category (age range: 11 years 5 months to 12 years 5 months)
AGE13	Dummy for Age 13 (1 = age 13; 0 = all other ages)	Pupil is in the 13-years age category (age range: 12 years 6 months to 13 years 5 months)
AGE14	Dummy for Age 14 (1 = age 14; 0 = all other ages)	Pupil is in the 14-years age category (age range: 13 years 6 months to 14 years 5 months)
AGE15	Dummy for Age 15 (1 = age 15; 0 = all other ages)	Pupil is in the 15-years age category (age range: 14 years 6 months to 15 years 5 months)
AGE16	Dummy for Age 16 (1 = age 16; 0 = all other ages)	Pupil is in the 16-years age category (age range: 15 years 6 months or above)

Table A2
Number of pupils involved in this study by variables of interest.

Age category	Pupil sex		Grade repetition		Wealth background			School type	
	Boys	Girls	Never repeated	Repeated at least once	Bottom 25%	Middle 50%	Top2 5%	Public school	Private school
10	144	270	334	80	120	149	145	227	187
11	747	1063	1524	286	448	634	728	973	837
12	1305	1319	1825	799	843	897	884	1545	1079
13	697	612	682	627	527	424	358	846	463
14	345	219	248	316	229	176	159	378	186
15	106	62	79	89	83	42	43	120	48
16+	105	47	68	84	70	38	44	107	45
ALL	3449	3592	4760	2281	2320	2360	2361	4196	2845

Table A3
Number of pupils involved in this study by county.

Age category	Geographical location (county)						Total
	Mombasa	Nairobi	Nyeri	Nakuru	Eldoret	Kisumu	
10	56	102	28	99	66	63	414
11	225	355	121	589	249	271	1810
12	433	640	107	696	312	436	2624
13	282	341	43	260	131	252	1309
14	121	131	20	130	61	101	564
15	30	37	9	43	21	28	168
16+	30	26	10	41	20	25	152
ALL	1177	1632	338	1858	860	1176	7041

Table A4
Models for estimating the impact of pupil age on literacy achievement ($N = 7041$).

(Comparison group)	Model 10 (Age 10)	Model 11 (Age 11)	Model 12 (Age 12)	Model 13 (Age 13)	Model 14 (Age 14)	Model 15 (Age 15)	Model 16 (Age 16+)
Grand mean	*49.59*	*51.31*	*48.96*	*46.85*	*43.40*	*42.38*	*41.46*
Pupil attends a Private school	8.86	8.86	8.86	8.86	8.86	8.86	8.86
Female pupil	1.90	1.90	1.90	1.90	1.90	1.90	1.90
Pupil has repeated a grade at least once	−5.21	−5.21	−5.21	−5.21	−5.21	−5.21	−5.21
Pupil wealth background	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Pupil age category (dummy variables)							
Age 10	×××	−1.71	0.64 ns	2.74	6.20	7.21	8.14
Age 11	1.71	×××	2.35	4.45	7.91	8.92	9.85
Age 12	−0.64 ns	−2.35	×××	2.11	5.56	6.57	7.50
Age 13	−2.74	−4.45	−2.11	×××	3.46	4.47	5.39
Age 14	−6.20	−7.91	−5.56	−3.46	×××	1.01 ns	1.94 ns
Age 15	−7.21	−8.92	−6.57	−4.47	−1.01 ns	×××	0.93 ns
Age 16+	−8.14	−9.85	−7.50	−5.39	−1.94 ns	−0.93 ns	×××

Table A5
Models for examining the relationship between age and literacy achievement across subgroups of pupils.

Model	Pupil sex		Grade repetition		Wealth background		Type of school	
	Boys ($N = 3449$)	Girls ($N = 3592$)	Non-rpt ($N = 4760$)	Repeaters ($N = 2281$)	Bottom 25% ($N = 2320$)	Top 25% ($N = 2361$)	Private ($N = 2845$)	Public ($N = 4196$)
Grand mean	*51.05*	*53.86*	*52.13*	*43.39*	49.43	52.02	*60.96*	*50.65*
Pupil attends private school	9.04	8.98	8.90	8.19	8.41	10.74	×××	×××
Female pupil	×××	×××	1.81	2.03	2.53	1.79	1.64	2.04
Pupil has repeated a grade at least once	−5.55	−5.32	×××	×××	−5.06	−5.07	−5.63	−4.88
Pupil wealth background	1.47	0.98	1.00	1.63	×××	×××	1.49	0.83
Pupil age category (dummy variables)								
Age 10	−2.34 ns	−1.55 ns	−1.75	−0.11 ns	−1.00 ns	−2.77	−1.44	−1.91 ns
Age 12	−2.10	−2.87	−2.95	0.05 ns	−3.06	−2.24	−2.71	−2.00
Age 13	−3.88	−5.23	−5.29	−1.37 ns	−4.28	−5.63	−5.46	−3.73
Age 14	−8.19	−7.84	−9.77	−4.87	−9.18	−8.67	−9.87	−6.78
Age 15	−6.22	−13.36	−11.15	−4.74	−8.58	−11.39	−9.89	−8.24
Age 16+	−9.13	−11.19	−12.40	−6.07	−9.03	−11.37	−13.36	−8.09

Notes: ××× = variable not available for testing in this model; ns = not significant; all the other variables are significant at $p = 0.05$ or less.

Table A6
Models of pupil literacy scores by geographical locations.

Model	Geographical location (county)					
	Eldoret ($N = 860$)	Kisumu ($N = 1176$)	Mombasa ($N = 1177$)	Nairobi ($N = 1632$)	Nakuru ($N = 1858$)	Nyeri ($N = 338$)
Grand mean	55.33	59.69	53.05	51.83	44.59	49.74
Pupil attends private school	4.39 ns	4.23 ns	12.93	4.00 ns	21.84	18.32
Female pupil	0.57 ns	1.63	0.83 ns	2.06	2.98	2.55 ns
Pupil has repeated a grade at least once	−3.90	−4.86	−6.29	−4.86	−5.73	−5.03
Pupil wealth background	1.50	0.98 ns	0.76 ns	1.01 ns	0.69 ns	2.36
Pupil age category (dummy variables)						
Age 10	−1.80 ns	−1.12 ns	−2.64 ns	−1.98 ns	−1.19 ns	−1.43 ns
Age 12	−4.93	0.72 ns	−4.00	−2.10 ns	−2.78	−0.39 ns
Age 13	−7.29	−2.30	−6.42	−4.22	−4.65	0.96 ns
Age 14	−14.61	−7.24	−10.48	−6.46	−4.91	−8.08
Age 15	−13.00	−8.17	−14.05	−12.39	−1.73 ns	−8.63 ns
Age 16+	−12.74	−11.98	−12.66	−15.65	−2.30 ns	−7.25 ns

Notes: ××× = variable not available for testing in this model; ns = not significant; all the other variables are significant at $p = 0.05$ or less.

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