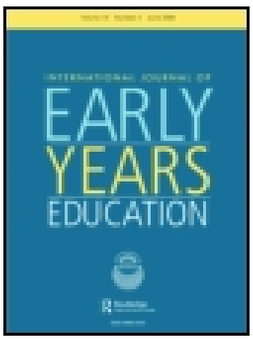

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Evaluating the Madrasa preschool programme in East Africa: a quasi-experimental study

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This study investigated the effect of preschool experience (two types of preschool: Madrasa and non-Madrasa) on the cognitive development of children in East Africa. In the three countries studied (Kenya, Uganda, and Tanzania/Zanzibar) preschool education is burgeoning and government standards are being set. This quasi experimental evaluation used four subscales (block building, verbal comprehension, early number concept, picture similarities) adapted from the British Ability Scale II (BAS II; discussed by Elliot, Smith and McCulloch in 1996), and three (verbal meaning, exclusion, closure) from the African Child Intelligence Test (ACIT; discussed by Drenth and colleagues in 1980). The development of 423 children was studied at pre-test (entry to preschool) and at post-test 18 months later. Hierarchical regression showed that children with both types of preschool experience performed better than the home (comparison) group; however, children attending Madrasa Resource Centre preschools achieved significantly higher scores overall.

Keywords: preschool evaluation; Africa; developing countries

Introduction

Since the turn of the century governments, communities, and policymakers in East Africa have shown an increasing interest in early childhood development. This new interest is evidenced by the inclusion of early childhood development in strategic education plans, and the development of policy and early childhood quality standard guidelines (Republic of Kenya 2006a, 2006b; Republic of Uganda 1998; Republic of Uganda 2007; Revolutionary Government of Zanzibar 1996; Revolutionary Government of Zanzibar 2005). Three East African countries (Kenya, Uganda, and Tanzania/Zanzibar) are currently in the process of developing policy guidelines for early childhood development programmes which clearly stipulate the national goals, objectives, and strategies of early childhood development in each country. The reasons for the new interest in the early childhood sector can be traced back to the accumulated evidence from empirical studies, primarily although not exclusively from the US and Europe, on the vital contribution to children's development of high quality early childhood experience. Community awareness about the role of preschool care and education in giving a head-start to children has led to increased demand for preschool opportunities in East Africa and consequently the mushrooming of private and public preschool institutions. The demand for preschools has also been exacerbated by the increased competition for the relatively limited supply of Grade 1 admission opportunities in sought-after primary schools. While the formal policies do not demand that children must have had preschool education

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before entry into primary school, informally the schools, particularly the competitive ones, demand evidence of preschool experience before children are admitted. Finally, this demand for high quality early childhood services emanates from the economic pressure on women to take up paid employment at a time when the family network structure is changing away from the traditional extended family towards more nuclear families and single parenthood (Swadener, Kabiru, and Njenga 2000).

In the national early childhood development policy guidelines, one of the invariant specifications across the three East African countries is the 'hands-off' stance in regard to the ownership and management of early childhood institutions within the policy of partnership. The ownership and management of such institutions remain largely in the hands of community, faith-based non-governmental organisation (NGOs), and private individuals. For example, more than 80% of all the preschools in Kenya are owned, managed and financed by the local communities (Swadener, Kabiru, and Njenga 2000). The policy documents stipulate the primary government function as that of registering early childhood institutions, developing curriculum guidelines and support materials, training of preschool teachers, and evaluating the preschools, thus relegating the role of ownership and management to the communities. Within communities, resources are mobilised to influence the contexts in which children learn and develop so that they are supportive of children's physical, cognitive, and psychosocial development. With more early childhood services in East Africa, the public and government both call for service delivery accountability within community-based initiatives.

One of the community-based early childhood programmes found across three East African countries (Kenya, Uganda, and Tanzania/Zanzibar) is the Madrasa Resource Centre (MRC) Early Childhood Programme. The communities served by the programme seek evidence on whether or not it makes a difference in children's development. The study reported here was designed to investigate whether (1) preschool education, in general, has a positive effect on the cognitive development of children and (2) whether the type of preschool attended, in this case Madrasa or non-Madrasa, makes a difference as well. This report focuses on the findings relating to the development of children in two different types of preschool compared to children who remained at home. In all three groups the intellectual development of children in the age range 3–6 years was studied.

Preschool research in the developed world

Studies on the benefits of preschool programmes on children's development have mostly been carried out in the USA and Europe (Marjanovič Umek et al. 2007; Spiess, Buchel, and Wagner 2003; Schweinhart 2001; Magnuson, Ruhm, and Waldfogel 2007; Ramey et al. 2000). There have been many papers reviewing the evidence for the vital role of early childhood programmes in child development (e.g., Leseman 2002; Melhuish 2004; Engle et al. 2007). Some of the studies in developed countries have demonstrated the long-term benefits of early intervention programmes for disadvantaged children. Such benefits include higher academic achievement and greater school success, higher employment rates, better health outcomes, and lower crime rates (Currie 2001; Currie and Thomas 2001; Karoly, Kilburn, and Canon 2005; Karoly et al. 1998; McCormick et al. 2006; Mustard 1999).

Effective Provision of Preschool Education (EPPE) project

EPPE is one of the more recent longitudinal studies to investigate the effects of early childhood education on child development (Sylva et al. 2004a). With over 3000 3–4-year old children sampled across various types of preschool settings in UK, the study demonstrated

not only that preschool experience, compared to none, enhances children's development but also that some individual preschool settings are more effective for positive child outcomes than others (Melhuish et al. 2001; Sammons et al. 2003a, b; Siraj-Blatchford et al. 2003; Sylva et al. 2004b). Using a similar design but researching in a different country, Melhuish et al. (2002) replicated the EPPE findings on 850 children in Northern Ireland. Many of the design aspects of the EPPE research were applied in the current study; for example, the child assessments and the quality observations.

Finally, the longitudinal research project The National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development examined the effects of childcare, family, and school experiences of 1,300 children since their birth in 1991. Higher quality preschool care was related to higher language ability, cognitive performance and higher level of school readiness (NICHD and Duncan 2003; NICHD 2005).

All the long-term studies have shown that academic success in primary school, resulting from high quality early childhood care and development experiences, translates into positive social and psychological adjustment later in secondary school, which is linked to better economic outcomes and social adjustment (Campbell et al. 2002; Currie 2001; Garces, Thomas and Currie 2000; McKey 2003, Reynolds et al. 2000, 2001; Reynolds and Robertson 2003; Schweinhart, Barnes and Weikart 1993). The aggregate impact is seen at personal, household, community, national, and global levels in terms of higher human productivity and socio-economic well-being (Barnett 2000).

Preschool research in developing countries

Some rigorous studies are now emerging from the developing world (Engle et al. 2007; Grantham-McGregor et al. 2007). Studies undertaken in developing countries have also shown better intellectual, academic, and behavioural outcomes in children who have attended high quality preschools (Barros and Mendonca 1999; Gorman and Pollit 1996; Liddell and Rae 2001). Other studies include Taiwo and Typolo (2002) which was a randomised control trial in Botswana of the development of children who attended preschool compared to those who did not. The outcomes were assessed in the first few weeks of Grade 1 and it was found that children who attended preschool had higher scores in language, mathematics, and science. Two recent studies in Bangladesh (Moore, Akhter, and Aboud 2008; Aboud 2006) have shown that the quality of the preschool in Bangladesh is related to cognitive school-readiness outcomes. The Moore et al. study used a pre-post intervention-control design and assessed quality through the Early Childhood Environment Rating Scale (Harms, Clifford, and Cryer 1998). Children in the two studies in Bangladesh were not randomly assigned to preschool condition, but there was effort to match the preschool children and the control children on socio-demographic measures.

It has been shown that early childhood programmes in developing countries can lead to a better start at school; lessen dropout, repetition and failure rates in primary school; and improve completion and success rates. These promising outcomes show that preschool education can potentially influence the survival rate in the education system, with larger increases gained by the most disadvantaged (Iglesias and Shalala 2002; Tarullo 2002).

Many donors have supported early childhood education/early child development programmes in developing countries. By 2005, the World Bank had provided loans totalling US$1680 million to 52 developing countries for child development programmes. Further, more than 30 developing countries had early child development policies in place and UNICEF was assisting governments in 60 countries in supporting parenting programmes aimed at enhancing children's development (UNICEF 2005).

Preschool in East Africa

While the policy messages have been clear and there is evidence of some investment, the current statistics do not show that Africa is moving in a positive direction. The population of Africa is living either in severe or chronic poverty. The effects are seen in terms of high-level malnutrition, high infant and under-five mortality rates, and low-level enrolment, completion and success rates in education. For example, 56% of the Kenyan population (of which 8.6 million are children) live below the poverty line, which is defined in terms of US$ 15 per month in rural areas and US$ 33 per month in urban areas (UNESCO 2001). Regarding levels of education, 30% of children drop out before finishing primary school education with only 56% finishing and between 13–19% of the children repeating at least one grade. The gross enrolment rate of preschool-aged children is below 50% and the Government of Kenya spends only 0.01% of total recurrent budget on early childhood education (ECD). Most (76%) of the preschool teachers are not trained.

Early Childhood Education is the generic term used in Kenya to refer to the Early Childhood Care and Education for Children's 0-5 years. The gross enrolment rate for Kenya in the age group 3–5 was 44.4% in 2001 (EFA global monitoring report 2005, UNESCO publishing). Many of the preschools are state-supported, although there are also many run by voluntary groups or by private individuals.

The Madrasa Resource Centre Early Childhood Programme

One of the major community-based early childhood programmes found across three East African countries is the Madrasa Resource Centre. The current study evaluated this programme, in comparison with other preschool programmes, in terms of its impact on the cognitive development of preschool children.

The Madrasa Resource Centre (MRC) Early Childhood Programme is a community-based initiative which was established in East Africa (initially in Mombasa in 1986 and then expanded to Zanzibar and Uganda in 1990 and 1993 respectively) to facilitate the development of quality, affordable, culturally appropriate, and sustainable early childhood centres among low-income communities. It has a well-established training programme for staff to sensitise, mobilise, and empower the community to establish and manage preschools with enriched classroom learning environments (Mwaura 2004). The teachers are trained in Islamic-integrated active learning pedagogy. The curriculum, which integrates secular and Islamic education, is based on a constructivist philosophy using the acronym MAMA-CHOLASU (MA: material; MA: manipulation; CHO: choice; LA: language; and SU: support; Madrasa Resource Centre 2000, 14). This philosophy values each child as an active agent of their own learning, and discovery of knowledge within a cultural context. The programme emphasises enrichment of the learning environment and high-quality teacher–child interaction. The programme recognises that children learn through active exploration and manipulation of objects and events both physically and mentally in a context of a secure, warm, and pedagogically stimulating human environment (Cornelius-White 2007). Such environments have been shown to foster more interactive and shared thinking between children and teachers (Sylva et al. 2007). In such enabling environments children spend more time in cognitively enriching activities (Tonyan and Howes 2003).

The MRC programme is currently supporting 203 community preschools in East Africa (66 in Kenya, 53 in Uganda and 84 in Zanzibar). The programme has benefited approximately 30,000 children in East Africa and trained over 4000 community-based teachers and 2000 School Management Committee (SMC) members. One unique feature of the programme is its operational strategies that involve the sensitisation and empowerment of

the communities in the establishment and management of quality preschool, and its religious integrated active learning curriculum.

Brown et al. (1999) carried out a brief, qualitative evaluation of the MRC Madrasa Preschool Programme and concluded that it has, in a quite systematic and committed way, attempted to answer important questions about effectiveness, including whether children do demonstrably benefit from early childhood programmes. Despite the Brown et al. (1999) study, there have been no rigorous empirical evaluation to follow up the early qualitative findings. This study responds to the need for scientific study to examine the impact of the MRC early childhood programmes in East Africa on the development of children.

Methods

Research questions

The study investigates whether different types of preschool vary in their effects. This study examined the impact of the Madrasa Resource Centre Preschool Programme on the cognitive development of preschool children in the first two years of preschool in comparison with other 'normative' (national or regional) preschool programmes found in East Africa and compared them to children with no preschool experience. The research questions were:

(1) Does preschool attendance lead to higher scores on cognitive tests compared to children who remain at home after controlling for age and parental education?
(2) Does the type of preschool experience (Madrasa Resource Centre or national/regional programme) have an effect on the cognitive development of preschool children when compared to home school children and controlling for age and parental education?

Study design

Participants of this study were preschool children from 47 preschool centres sampled from Kenya, Uganda, and Zanzibar. Data reported in this study were collected as part of a larger study designed to examine the impact of the MRC Early Childhood Programme in East Africa. The main study was carried out between 1999 and 2005 in the three East African countries and included a total of 906 children. It used a pre-test/post-test quasi-experimental design with an intervention group (children from the Madrasa Resource Centre Programme) and two comparison groups (children from non-Madrasa preschools and children with no preschool experience/home children). The data reported here are from the children who were pre-tested upon entry into preschool and then post-tested in the last three months of their second year in preschool. In the case of home children, the post-tests were carried out at a time that matched the test dates of the preschool children in the study.

Sample

At preschool level

In each East African country, eight MRC preschools and eight non-MRC preschools were sampled. One preschool dropped out, leaving a sample of 47 preschools. Preschools were matched in terms of the number of trained teachers and geographical regions. Each pair of MRC and non-MRC preschools was chosen from within the same community, but with a minimum distance of between one and three kilometres apart. To be included in the study,

preschools had to have been operational for at least two years at the pre-test period; furthermore they had to be either community-owned or managed or initiated by the governments for the community, as opposed to the for-profit private preschools. In Kenya, selected non-MRC centres were mostly municipal-run preschools or community preschools where teachers were trained, supervised, and mentored by the District Centre for Early Childhood Education (DICECE). In Uganda the selected non-MRC preschools were preschools run and managed by groups of community persons, while in Zanzibar the selected non-MRC preschools were government initiated. In each country the MRC and non-MRC preschools were following the broad guidelines of their national guidelines.

At classroom level

In each school, one classroom was selected on the basis of the age of the children, ideally starting with the three-year-olds; when this was not possible, selection was based on the next age group. This was an issue particularly in Zanzibar where most children enter preschool at age four or five years. In schools with more than one entry classroom (with age three, four or five being youngest) the choice of the classroom was made randomly, provided that all teachers were trained.

At child level

A sample of 10 to 17 children of age 3–5 was randomly selected from the register in each classroom sampled. The sampling process at child level started with the children of age three before sampling from the next age group. For the comparison group, at least 10 children from each of the communities surrounding the sampled school, who did not attend preschool, were recruited to the study. These home children were identified through the assistance of the local civic and opinion leaders as well as preschool teachers. Table 1 gives the sample characteristics of children who had both pre and post tests.

In total 423 children were pre-tested and post-tested with 45%, 33% and 22% of the total sample coming from Zanzibar, Kenya and Uganda respectively (Table 1). Among these children 49% were girls and 51% were boys which is the approximate ratio of girls and boys in preschools in East Africa. At pre-test most of the children were between age four and five (70%) while the three-year-olds comprised 19% of the sample. A small number (8%) were above five years of age as they were attending classrooms serving the younger children.

Cognitive ability measures and timing of assessments

In this study the dependent variable was the children's cognitive attainment. The main predictor was preschool experience (Madrasa preschool, state or regional preschool, or no preschool) while the demographic co-variates were child characteristics (age and gender) and the parent's education level. The seven outcome measures of cognitive development were chosen because they include language skills, early number skills, and non-verbal reasoning skills, all of which contribute to 'school readiness' but in different ways.

Data on children's cognitive ability were collected at pre-test and post-test through four subscales (block building, verbal comprehension, early number concept, and picture similarity) of an adapted version of British Ability Scales II (BAS II; Elliot, Smith, and McCulloch 1996) and three subscales (verbal meaning, exclusion, and closure) of the African Child Intelligence Test (ACIT; Drenth et al. 1980). These tests assessed three

Table 1. Sample characteristics (children with data at pre- and post-test).

Variable		Home *n*=99 n (%)	Non-MRC *n*=157 n (%)	MRC *n*=167 n (%)	Total *n*=423
Country					
	Zanzibar	43 *(43)*	74 *(47)*	72 *(43)*	189 *(45)*
	Kenya	44 *(44)*	45 *(29)*	50 *(30)*	139 *(33)*
	Uganda	12 *(12)*	38 *(24)*	45 *(27)*	95 *(22)*
Cohort					
	cohort 1	49 *(49)*	75 *(48)*	84 *(50)*	208 *(49)*
	cohort 2	50 *(51)*	82 *(52)*	83 *(50)*	215 *(51)*
Gender					
	male	55 *(56)*	73 *(47)*	74 *(44)*	202 *(48)*
	female	44 *(44)*	84 *(53)*	93 *(56)*	221 *(52)*
Age-group					
	3-year-olds	17 *(17)*	29 *(19)*	33 *(20)*	79 *(19)*
	4-year-olds	33 *(33)*	68 *(43)*	69 *(41)*	170 *(40)*
	5-year-olds	32 *(32)*	48 *(31)*	49 *(29)*	129 *(30)*
	over 5 years	14 *(14)*	10 *(7)*	15 *(9)*	34 *(8)*

domains of school readiness: language skill, number skill, and non-verbal reasoning. The baseline data were collected during the first four months upon the children's entry into preschool and in the last three months of their second year in preschool.

The British Ability Scales II (BAS II)

The British Ability Scales II (Elliot, Smith, and McCulloch 1996) are measures of cognitive ability that can be used over a wide age range. The cognitive scales are designed to measure abilities that are predictive of learning and educational performance and are divided into those that contribute to the general conceptual ability and those that provide additional information on specific skills.

Following extensive pilot testing of children in the region, four of the six BAS II Early Years scales that contribute to the general conceptual ability were selected on the basis of conceptual suitability and adaptability. These were verbal comprehension (comprised of 40 items) to test language ability, picture similarities (comprised of 33 items) to test pictorial (non-verbal) reasoning, and early number concepts (comprised of 30 items). Block building (comprised of 16 items) was selected to measure visual–perceptual matching of spatial orientation in copying block patterns. Verbal comprehension specifically measured receptive language in terms of understanding of oral instructions involving basic language concepts while early number concepts tested knowledge of, and problem-solving using, pre-numerical and numerical concepts. Picture similarities assessed non-verbal reasoning shown by matching pictures that have a common element or concept. The test items were modified somewhat to suit the East African context.

The BAS has good reliability, internal consistency, and test-retest reliability/validity, at least in Western countries (Hill 2005). Its measures correlate well with other validated child assessment instruments such as Wechsler Intelligence Scale for Children – Third Edition

(WISC-III; Wechsler 1991). The subscales of this test have been shown to predict school entry profiles and subsequent academic attainment (Sylva et al. 2004a).

African Child Intelligence Test (ACIT)

This test is an adapted version of the original Amsterdamse Kinder Intelligentie Test which has since been revised (AKIT; Bleichrodt et al. 1984). The test is a simple, individually administered test adapted to suit the East African context and the character of preschool children. Of the 11 scales comprising the ACIT battery, three were selected for use in this study. These are exclusion, closure, and verbal meaning. Exclusion is a 46-item reasoning test in which the child's task is to choose from one abstract figure or object from a selection of four that does not satisfy a rule that the other three do. This task involves both the discovery of a class principle (or 'concept') as part of concept-formation, and reasoning ability since the child has to carry out mental manipulation of the material presented, put forward hypotheses and check them. In the closure test (comprising 28 items) children are shown incomplete drawings from which he or she has to try to recognise what the incomplete object is. The test assesses children's ability in visual cognition of figural units. Finally, the verbal meaning test consisted of 40 items. In each item four different pictures are shown and the child must choose the object, animal, situation, quality etc. as named by the test administrator. The test follows the classical vocabulary type test in which children are tested on the ability to recognise semantic units and also the ability to recognise behavioural situations, which belong to a certain word category (Drenth et al.1980).

The exact age of many children was not known as teachers, parents, and school records provided the age of each child in years. For this reason the BAS and ACIT could not be administered and scored in its standardised way and a decision was taken to administer it as a criterion-referenced test. On the basis of raw scores, children were given a percentage score for each subscale. This strategy has been used successfully for the BAS in other evaluation studies carried out in Africa (Engle et al. 2007).

Child and family measures

Information such as parental educational level and occupation was acquired through interviews at home or at school. The parents of preschool children were invited to the school by the teachers for the interview while the parents of the home children were interviewed at home. Information on children's age and gender was collated from the school register for preschool children and gathered during the interviews with the parents of the home children.

Procedures

Twelve graduate assistants (four from each country) were trained in the administration of the cognitive tests and interviewing. The training gave special emphasis not only to the technical aspects of child assessment and interviewing, but also to the creation of suitable and appropriate test-taking conditions. The training took a participatory approach with an integration of both theory and practice. During the training the data collectors had three sessions of practical testing on preschool children (not involved in the study) in pairs, (one person observing the other testing in one session and exchanging the roles in the other session). After each session the data collectors had a reflective meeting to discuss the issues and challenges of the exercise. The translation of instruction/assessment took a multiple translation strategy. First, the data collectors read the instructions for tests or interviews in English.

They discussed these in terms of concepts used and what was being asked of the child. This was followed by the translation of the instructions into the language of the child or parent. The translated script was then handed over to an expert in the language for validation before being implemented in the research. At the end of each of the translation stages a reflective discussion took place between the data collectors and the first author for further deliberation, understanding, and consensus.

All cognitive assessments of the children and interviews with parents were administered on a one-to-one basis. Each data collector visited the school for a continuous period of two weeks. The first two days were devoted to familiarisation and the creation of rapport with the children. It was also the time that the data collectors got acquainted with the documents, including the lists of names in the school, as a preparation to the sampling exercise for home children.

Research findings

Analysis strategy

The scores of children attending the two different preschool types were compared to scores of children from similar communities who remained at home. More specifically the study aimed to assess the relative contribution of the two types of preschool to the cognitive development of the children after accounting for child and background factors (the demographic co-variates).

The test data met the requirements for parametric statistics. Descriptive statistics are presented first, followed by hierarchical regressions. The age of the child was classified into three, four, five, and six-plus years; parents education into low, medium, and high; and the type of preschool provision was classified as home, non-MRC, and MRC. First to be entered as a block were the children's pre-test scores, age, gender, and parent's education level. Next the variable non-MRC and MRC preschool provisions (referenced to the home children) was added in order to examine the unique influence of the two preschool programmes on the cognitive development of preschool children after taking into account demographic factors. All statistical analyses were conducted with SPSS version 14.

Relationship between test scores

Table 2 shows the correlation between the subscales in the pre-test and post-test respectively. At the pre-test the average correlation was $r = .41$ (range .20–.58) and at time 2 $r = .50$ (range .34–.66). Cronbach's alpha for the mean of the seven cognitive subscales was .81 and

Table 2. Bivariate correlation of pre- and post-test inter-item correlations (pre-test on lower side of diagonal).

	1	2	3	4	5	6	7
1 Block building	–	0.42	0.39	0.50	0.48	0.50	0.47
2 Verbal comprehension	0.52	–	0.48	0.63	0.54	0.56	0.34
3 Early number concept	0.42	0.50	–	0.48	0.49	0.45	0.50
4 Picture similarities	0.39	0.44	0.40	–	0.57	0.63	0.38
5 Verbal meaning	0.20	0.30	0.37	0.25	–	0.66	0.50
6 Exclusion	0.38	0.39	0.42	0.44	0.58	–	0.55
7 Closure	0.47	0.52	0.42	0.43	0.37	0.49	–

.86 for the pre- and post-tests respectively, indicating internal consistency of the overall scores.

Cognitive performance at pre-test and post-test

Table 3 shows the mean scores and standard deviation of the pre-test and post-test scores on all subscales. The mean scores are higher for the preschool children (both MRC and non-MRC) than the home children in all the subscales at pre-test; however, the standard deviation is higher for the preschool than home children. The mean cognitive scores are higher for the MRC preschool children than children from non-MRC preschool and the non-MRC preschool children had higher mean scores in all the tests than home children. In general the variation in cognitive scores is higher for non-MRC children than both MRC and home children in almost all tests. Comparatively, home children had higher scores in non-verbal test items (block building and picture similarities) on the BAS subscale than verbal and numeric tests at pre-test and post-test, while for preschool children there is a mixed result.

Effects of preschool experience on cognitive outcomes (total scores)

One of the objectives of this study was to establish the contribution of preschool experience to the development of total (or global) cognition. A sequential regression analysis was employed with total cognitive performance (summed across all seven subscales) as the dependent measure. First, age and parents' education were categorised and together with type of preschool provision turned into dummy variables. Ages four, five and five-plus (older than five) were compared to the reference group (age four). The parents' education levels of secondary (medium education level) and above secondary (high education level) were compared to the reference group primary education level (low education). MRC and non-MRC children were referenced to home children.

In the first statistical analysis on total scores (see Table 4), the variables of pre-test score, age, gender, and parents' education were entered as a block (model 1). Next, the type of preschool provision (MRC and non-MRC) dummy variables were added (model 2), with the total post-test cognitive score as the dependent variable. Results from the hierarchical regression analysis (including standard error (*SE*) coefficients, unstandardised (*B*) and standardised beta (β) coefficients, and significance levels), are shown in Table 5. About 13% (R^2=.129) of the variation in cognitive scores at post test is explained by model 1 (with pre-test, age, gender, and parents' education level as independent variables) while model 2 (with MRC and non-MRC dummy variables added) explains 25.2% (R^2 = .252) of the variation in total cognitive scores. The following variables were found to significantly predict total cognitive score: pre-test (β = .201, p < .05); age four (β = .224, p < .05); age 5 (β = .179, p < .05); age above five years (β = .171, p < .05); non-MRC (β = .204, p < .05); and MRC (β = .441, p < .05). Having controlled for pre-test, age, gender, and parents' education level, preschool provision significantly predicted the total cognitive test scores with MRC provision showing a more than double standardised coefficient (β = .441) compared to non-MRC provision (β = .204).

Effects of preschool experience on clusters of tests

Having established that children attending both types of preschool scored better than the home children on total scores, the effect of preschool education on a 'meaningful' cluster of tests was explored. Table 5 shows the unstandardised β, standardised β and the standard

Table 3. Pre-test and post-test mean scores by type of pre-school provision.

		Pre-test			Post-test		
Variable		Home *n*=99 Mean *(S.D.)*	Non-MRC *n*=157 Mean *(S.D.)*	MRC *n*=167 Mean *(S.D.)*	Home *n*=99 Mean *(S.D.)*	Non-MRC *n*=157 Mean *(S.D.)*	MRC *n*=167 Mean *(S.D.)*
BAS-subscales							
	Block building	30.43 *(21.5)*	34.91 *(24.8)*	35.33 *(26.1)*	60.67 *(21.3)*	63.45 *(24.3)*	72.04 *(20.9)*
	Verbal comprehension	29.89 *(14.3)*	38.23 *(17.2)*	37.83 *(17.3)*	49.95 *(14.6)*	56.93 *(19.2)*	63.11 *(14.3)*
	Number concept	14.01 *(12.1)*	19.49 *(12.2)*	19.16 *(13.9)*	45.76 *(30.6)*	61.21 *(30.7)*	68.40 *(26.4)*
	Picture similarities	31.53 *(20.2)*	45.11 *(27.0)*	44.37 *(24.6)*	51.27 *(23.0)*	58.54 *(24.6)*	64.71 *(21.4)*
ACIT							
	Verbal meaning	25.78 *(21.3)*	30.62 *(26.2)*	27.34 *(24.6)*	45.88 *(20.2)*	52.4 *(22.8)*	63.39 *(19.4)*
	Exclusion	14.73 *(14.8)*	15.91 *(17.4)*	14.09 *(16.6)*	30.30 *(18.8)*	41.72 *(20.2)*	49.1 *(21.3)*
	Closure	18.87 *(17.7)*	20.34 *(19.0)*	21.00 *(20.1)*	37.37 *(30.6)*	57.59 *(33.3)*	67.94 *(30.8)*

Table 4. The effect of early childhood education on cognitive performance (total scores).

	B	*SE*	*β*
Model 1			
(Constant)	41.892	2.777	
Pretest	.321	.062	.244**
Gender (reference = boys)	−.870	1.696	−.024
Age 4 (reference = age 3)	8.188	2.432	.220**
Age 5 (reference = age 3)	5.470	2.561	.138**
Age 6 (reference = age 3)	9.617	3.560	.146**
Medium parents' education (reference = low education	−2.442	2.133	−.061
High parents' education (reference = low education)	3.540	2.100	.093
R^2	12.9%		
Model 2			
(Constant)	33.619	2.842	
Pre-test	.264	.058	.201**
Gender (reference = boys)	−1.994	1.583	−.054
Age 4 (reference = age 3)	8.366	2.261	.224**
Age 5 (reference = age 3	7.072	2.392	.179**
Age 6 (reference = age 3	11.285	3.340	.171**
Medium parents' education (reference = low education	−1.341	1.986	−.034
High parents' education (reference = low education)	3.121	2.009	.082
Non-MRC (reference = home children)	7.781	2.197	.204**
MRC (reference = home children)	16.772	2.105	.446**
R^2	25.2%		
Δ in R^2 due to intervention	12.3%		

**significant at $p = .05$.

error of the variables factored into the model predicting the three pre-academic subscales: verbal comprehension (BAS), early number concepts (BAS), and verbal meaning (ACIT). Model 1 (with pre-test, age, gender and parents' education level as independent variables) explains 8.5%, 8%, and 5.4%, of the variance (verbal comprehension, early number concept, verbal meaning). Model 2 (with pre-test, age, gender and parents' education level, and types of preschool provision as independent variables) explains 16.8%, 15% and 16.3%, of verbal comprehension, early number concept, and verbal meaning. MRC provision had the highest standardised coefficient and significantly predicted all the subtest scores (Verbal comprehension: $\beta = .37$, $p < .05$; early number concept: $\beta = .35$, $p < .05$; verbal meaning: $\beta = .39$, $p < .05$).

Table 6 reports the regression results on the non-verbal reasoning outcomes. Model 1 (with pre-test, age, gender and parents' education level as independent variables) explains 5.4%, 15.2%, 9.7% and 9.6% of block building, picture similarities, exclusion and closure scores variability respectively. Model 2 (with pre-test, age, gender and parents' education level and types of preschool provision as independent variables) explains 10%, 19.2%, 18.2% and 20.3% of block building, picture similarities, exclusion and closure scores variability respectively.

Looking at Tables 5 and 6, MRC provision (compared to the children remaining at home) had the highest standardised coefficients and significantly predicted all the subtest

Table 5. Effect of pre-school on three clusters of 'pre-academic' skills.

	Verbal comprehension			Early number concept			Verbal meaning		
	B	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Model 1									
(Constant)	47.66	2.87	-	44.38	4.44	-	43.75	3.14	-
Pre-test	0.04	0.05	0.04	0.39	0.11	0.17**	0.00	0.05	0.00
Gender (reference = boys)	−0.34	1.61	−0.01	−2.56	2.86	−0.04	−0.28	2.11	−0.01
Age 4 (reference = age 3)	10.34	2.27	0.30**	13.96	4.06	0.23**	10.19	2.99	0.23**
Age 5 (reference = age 3)	9.29	2.41	0.25**	4.12	4.29	0.06	10.62	3.30	0.22**
Age 6 (reference = age 3)	9.93	3.36	0.16**	5.80	5.98	0.05	13.29	4.44	0.17**
Medium parents' education (reference = low education)	−2.85	2.03	−0.08	4.78	3.61	0.07	1.95	2.66	0.04
High parents' education (reference = low education)	3.86	2.00	0.11**	3.43	3.56	0.05	5.92	2.62	0.13**
R^2	8.5%			8.0%			5.4%		
Model 2									
(Constant)	42.02	2.94	-	32.56	4.80	-	34.52	3.41	-
Pre-test	0.00	0.05	0.00	0.30	0.11	0.13**	0.00	0.04	0.00
Gender (reference = boys)	−1.20	1.55	−0.04	−4.00	2.77	−0.07	−1.36	2.00	−0.03
Age 4 (reference = age 3)	10.32	2.17	0.30**	13.85	3.91	0.23**	10.07	2.82	0.23**
Age 5 (reference = age 3)	10.12	2.31	0.28**	5.97	4.15	0.09	11.99	3.12	0.25**
Age 6 (reference = age 3)	10.97	3.24	0.18**	8.33	5.81	0.08	14.24	4.22	0.18**
Medium parents' education (reference = low education)	−2.08	1.94	−0.06	6.16	3.49	0.09	3.11	2.51	0.07
High parents' education (reference = low education)	3.65	1.96	0.10**	1.92	3.53	0.03	6.00	2.55	0.13**
Non-MRC (reference = home children)	5.65	2.16	0.16**	13.82	3.85	0.22**	5.69	2.76	0.12**
MRC (reference = home children)	12.78	2.07	0.37**	21.42	3.69	0.35**	17.76	2.64	0.39**
R^2	16.8%			15.0%			16.3%		
ΔR^2 due to intervention	8.3%			6.9%			10.8%		

**significant at $p = .05$.

Table 6. Effect of pre-school on non-verbal skills.

	Block building			Picture similarities			Exclusion			Closure		
	B	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Model 1												
(Constant)	59.99	3.42		43.47	3.36		32.22	2.97		46.20	4.80	
Pre-test	0.12	0.05	0.13**	0.11	0.04	0.11**	0.08	0.06	0.06	0.48	0.08	0.28**
Gender (reference = boys)	−5.10	2.20	−0.11**	−0.43	2.13	−0.01	0.99	2.02	0.02	−1.62	3.16	−0.02
Age 4 (reference = age 3)	4.60	3.11	0.10	14.59	3.10	0.31**	11.88	2.86	0.27**	2.26	4.45	0.03
Age 5 (reference = age 3)	3.74	3.27	0.08	15.92	3.24	0.32**	8.91	3.07	0.19**	−3.72	4.73	−0.05
Age 6 (reference = age 3)	9.12	4.56	0.11**	19.88	4.55	0.24**	14.31	4.24	0.19**	6.68	6.59	0.06
Medium parents' education (reference = low education)	−1.28	2.77	−0.03	−7.89	2.70	−0.16**	−7.27	2.54	−0.16**	−3.19	3.98	−0.04
High parents' education (reference = low education)	3.62	2.70	0.08	3.34	2.63	0.07	3.59	2.49	0.08	6.56	3.89	0.09
R^2	5.4%			15.2%			9.7%			9.6%		
Model 2												
(Constant)	54.95	3.77		37.80	3.64		21.60	3.25		28.62	5.17	
Pre-test	0.11	0.04	0.11**	0.07	0.04	0.08	0.08	0.06	0.06	0.46	0.08	0.26**
Gender (reference = boys)	−5.85	2.16	−0.13**	−1.17	2.09	−0.02	−0.11	1.91	0.00	−3.39	2.98	−0.05
Age 4 (reference = age 3)	4.72	3.04	0.10	14.98	3.03	0.31**	11.48	2.70	0.26**	1.60	4.20	0.02
Age 5 (reference = age 3)	4.47	3.21	0.09	17.17	3.19	0.34**	10.33	2.91	0.22**	−1.26	4.47	−0.02
Age 6 (reference = age 3)	9.35	4.49	0.11**	21.32	4.51	0.25**	15.94	4.03	0.21**	9.92	6.25	0.08
Medium parents' education (reference = low education)	−0.39	2.71	−0.01	−7.30	2.64	−0.14**	−6.24	2.40	−0.13**	−1.57	3.75	−0.02
High parents' education (reference = low education)	4.18	2.72	0.09	3.17	2.66	0.07	2.49	2.43	0.06	4.01	3.78	0.06
Non-MRC (reference = home children)	1.83	2.96	0.04	4.81	2.95	0.10	9.87	2.63	0.22**	18.90	4.11	0.27**
MRC (reference = home children)	11.18	2.84	0.24**	12.10	2.82	0.25**	18.13	2.52		29.39	3.94	0.43**
R^2	10.0%			19.2%			18.2%			20.3%		
ΔR^2 due to intervention	4.7%			4.0%			10.2%			10.7%		

**significant at $p = .05$.

scores. The children in the non-MRC differed significantly from the home children in four of the subscales (exclusion, verbal comprehension, early number concept, and verbal meaning). Age significantly affected five of the subscales (block building, picture similarities, exclusion, verbal comprehension, and verbal meaning). Parents' education predicted only two subscales (verbal comprehension and verbal meaning). Having controlled for pre-test, age, gender, and parents' education level, MRC experience therefore had a significant effect on all the cognitive subscales and this effect was stronger than the effect on the non-MRC preschools.

Discussion

The main purpose of this study was to explore the effects of preschool experience on the cognitive development of young children in East Africa. The effects of preschool were demonstrated through hierarchical multiple regressions for pre-academic and non-verbal reasoning outcomes after controlling for pre-test. Finally, the study examined which child and family variables significantly predicted children's cognitive performance at preschool level. All the regression analyses showed substantial child age and parent education effects but no gender effects. This is encouraging because the well-known gender differences (Sammons et al. 1999) appear absent at this age.

Preschool experience and cognitive achievement

This study found that attendance at both types of preschool has positive effects on the cognitive achievement of preschool children compared to home children, even after controlling for pre-test child and family characteristics. While attendance of both Madrasa Resource Centre and non-Madrasa preschool was found to significantly predict cognitive achievement, the effect was higher for the Madrasa Resource Centre children than the non-Madrasa children. Secondary analysis on the value added on the cognitive performance between pre- and post-tests indicated higher values for Madrasa Resource Centre children than the non-Madrasa and home children in all the subscales. This study therefore shows that the type of preschool attended influences the extent of the impact of cognitive development on children. Although this study did not focus specifically on the explanation of the difference between the two types of preschool, earlier studies comparing the quality of teaching and learning environment (Mwaura 2008) showed that Madrasa Resource Centre preschools had significantly better quality than the non-Madrasa preschools included in this study. Given that the quality of preschool teaching and learning environment is an important predictor of cognitive development (Moore, Akhter, and Aboud 2008; Sylva et al. 2007), the better quality environment enjoyed by the Madrasa Resource Centre children may explain their superior cognitive performance.

Other predictors of cognitive achievement

Other variables were found to be significant predictors of the total cognitive score. These include pre-test score and age at four, five and six (reference age being three). The study found no significant gender effect on cognitive performance but it was surprising that the parents' education also did not have a significant effect on cognitive performance. Some studies (NICHD 2001) have found parents' education, particularly the mother's education level, to be a significant predictor of child development.

Limitations and future directions

This study had four main limitations. The first limitation relates to the age standardisation of scores. Because many of the preschools did not have records of the exact date of birth for the children, age was modelled in years and not in months. This limitation meant that the standard method of scoring data for analysis on the subscales adapted from BAS and ACIT was not possible and percentages were used instead in a criterion-referenced test. The second limitation was attrition of children, with loss of children experienced more in the home group. The third limitation is the 'novelty' of a new programme and the possibility that some kind of halo-effect is operating to increase children's learning. This is unlikely since the programme is now 25 years old and operates in 203 preschools across East Africa. A final limitation relates to the time-frame of the study. This study focused on development during preschool and not on school readiness measured at primary school entry. In the future it will be important to study children's development beyond preschool (Mwaura 2008), and to explore the effects of preschool on social as well as cognitive outcomes.

Conclusion

The findings of this study provide important evidence from an East African context that preschool experiences are important in nurturing cognitive development in terms of academic skills and also non-verbal reasoning. Importantly, the type of preschool that a child attends also matters. Attendance at the Madrasa Resource Centre schools has a stronger impact on children's development than attendance at a non-MRC preschool, although both types of programme give children an intellectual 'boost' compared to remaining at home.

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