

Zambian Preschools: A Boost for Early Literacy?

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Received: September 6, 2015

Accepted: October 12, 2015

Online Published: October 15, 2015

doi:10.5430/elr.v4n4p1

URL: <http://dx.doi.org/10.5430/elr.v4n4p1>

Abstract

This study examined whether and how Zambian preschool education stimulates learning to read. A total of 216 children including 118 with a preschool background were tested at the start of first grade and again approximately eight months later. The Basic Skills Assessment Tool for reading and writing (BASAT) was applied at both measurements. Basic skills at the start of first grade were not better when children had been to preschool but did predict academic success in first grade. Multilevel regression analysis revealed that preschool even had a negative effect on reading and writing at the end of first grade when we controlled for basic literacy skills at the start of first grade. We discuss the use of English in preschool as a possible explanation for the negative effects of preschool.

Keywords: Preschool, Zambia, learning to read, Language of instruction, Basic literacy skills

1. Introduction

Becoming literate starts long before children receive formal reading instruction. As a result of daily experiences such as book reading, young children construct knowledge not only about text (e.g., Clay, 1982; Sulzby, 1985) but also about print (e.g., Both-de Vries & Bus, 2008, 2010; Levin, Both-de Vries, Aram, & Bus, 2005). Children learn how to handle a book, and may pretend to read and tell a story while looking at the pictures. Most kindergartners have a nascent awareness of the sound-symbol relationship in printed words and have begun to accrue baseline knowledge of a small assemblage of letters and sounds as is demonstrated in their invented spelling attempts (e.g., Treiman & Kessler, 2003). The National Institute for Literacy (NIFL, 2007) concluded that reading skills acquired during preschool age provide the essential foundational links required for later reading success. Due to sparse experiences in the early years (Snow, Griffin, & Burns, 2005), Zambian children may miss the chance to develop competencies fundamental to learning to read (Duncan, Dowsett, Claessens et al., 2007) and their capacity to benefit from beginning reading instruction may be compromised (Bus, 2001). On the other hand, unlike primary education in Western countries, Zambian primary education may be attuned to limited knowledge acquired in preschool age and beneficial effects of instruction in first grade may depend less on early acquired literacy skills.

1.1 Preschool: A Boost for Early Literacy?

Preschool education typically provides experiences that foster literacy practices and may thus be a boost for early literacy skills and success in first grade (e.g., Dickinson & Smith, 1994). Similar to preschools in Western countries, the preschool curriculum in Zambia involves singing songs, hearing stories, and learning the alphabet thereby stimulating basic literacy skills such as rhyming, story comprehension, and letter knowledge. The Zambian situation lends itself for a natural experiment for testing the importance of preschool as preschool attendance is not obligatory and only a small percentage of Zambian children go to preschool. In the current study we tested whether Zambian preschool creates a better starting position for learning to read in primary education by comparing pupils who went to preschool and pupils who did not at the start and the end of first grade.

According to the situation analysis of Early Childhood Education instituted by UNICEF in 2007, teaching at preschools in Zambia is mainly done in English, which may make Zambian preschool less effective (Matafwali & Munsaka, 2011). In Lusaka, it may be particularly confusing given that English is the language of instruction in preschool while most children speak another language at home and on the playground and Nyanja, one of the local Zambian languages, is the language of instruction in first grade. There is an abundance of literature showing that games, stories, songs, rhymes and names in the language of instruction are indispensable as a step up to beginning literacy

skills such as letter knowledge, name writing and phonological awareness as well as reading simple words (e.g., Bishop & Adams, 1990; Bus, 2001; Chaney, 1992; Scarborough, 1989). Missing such knowledge may explain why practicing reading in an indigenous language that differs from the language spoken at home and in the playground interferes with learning to read in a Zambian language, even though the language of instruction and the most familiar language are both Bantu languages that have words and grammar in common (Tambulukani, 2015; Tambulukani & Bus, 2012). Both Matafwali (2010) and Tambulukani (2015) found that children progress more in first grade when the language utilized to teach reading is familiar to them because it is used at home and on the playground. Missing a solid foundation for adapting instruction in first grade to what is familiar to young children may complicate the process of teaching reading in first grade (Tambulukani, 2015). Strengthening the precursors for learning to read by familiarizing children with games, stories, songs and rhymes in the language of instruction may be doomed to failure when the language of teaching in preschool is English.

1.2 Preschool: A Boost for Executive Functions?

Apart from preschool influencing basic literacy skills, we tested effects on the ability to retain information (short-term memory), to ignore distraction and to resist making the most obvious response and instead make another (inhibition), and to focus attention and stay focused (sustained attention) (e.g., Blair, Zelazo, & Greenberg, 2005; Davidson, Amso, Anderson, & Diamond, 2006; McClelland, Acock, & Morrison, 2006). Preschool may promote executive functions and, through that, the ability to benefit from the school curriculum (Davidse, de Jong, Bus, Huijbregts, & Swaab, 2011; Diamond, Barnett, Thomas, & Munro, 2007). When children do not attend preschool, they may be less likely to benefit from literacy activities in school because they are less in control of their learning behavior (Bodrova & Leong, 2012; Kegel, van der Kooy-Hofland, & Bus, 2009).

On the other hand, there is evidence showing that preschool may negatively interfere with the development of executive functions due to a noisy and chaotic environment in which children fail to concentrate on tasks (Kirby, Youmans, & Freeman, 2015). Despite previous research demonstrating benefits of full time kindergarten, especially for children from disadvantaged homes (e.g., Sektnan, McClelland, Acock, & Morrison, 2010), Kirby and colleagues reported a mild negative effect on self-regulation for Canadian children in full-day kindergarten. They speculated that, due to a noisy and crowded environment, children may not receive incentives to stay attentive during activities and, due to numerous distractors, they may fail to follow a plan when solving problems.

1.3 This Study

The main purpose of this study was to test whether, due to preschool attendance, pupils have higher scores on basic reading skills at the start of grade 1 and whether preschool is a boost for reading instruction in grade 1. As children have a head start in grade 1 as a result of preschool, they may benefit more from formal reading instruction and outperform their peers without preschool education at the end of the first year of formal instruction. A complicating factor is that teaching in preschool is in English. It may therefore not contribute to precursors of literacy: songs, rhymes and stories in the Zambian language of teaching as a step up to basic reading skills.

When testing the effects of preschool, we also took account of executive functions as an explanation for positive or negative effects of preschool. Preschool may help to develop executive functions and through that learning to read in first grade. However, if preschool is chaotic and noisy, we may expect a negative impact of preschool on reading development mediated by attention problems. Executive functions may mediate any effects of preschool on academic skills, at the start as well as at the end of first grade. To rule out the possibility that executive function measures assess the same as intelligence tests and not something extra as assumed in the literature (e.g., Diamond et al., 2007), we tested the effects of preschool on executive functions while we controlled for intelligence. When testing the long-term effects of preschool on reading and writing at the end of first grade, we also took account of whether or not the Zambian language of instruction is familiar to the children.

In sum, the main aims of this study were to test:

1. effects of preschool on basic literacy skills and executive functions at the start of first grade controlling for background variables like intelligence and socio-economic status;
2. effects of basic literacy skills and executive functions at the start of the year on reading and writing skills after one year of instruction in grade 1 controlling for background variables including familiarity with the language of instruction in grade 1;
3. long-term effects of preschool on reading and writing at the end of grade 1 controlling for basic literacy skills and executive functions at the start of grade 1 and for background variables including familiarity with the language of instruction in grade 1.

2. Method

2.1 Design

This study was a quasi-experimental design in which the researcher compared children who had attended preschool and those who had not attended preschool. Children from 18 schools in Lusaka District were tested at the start of grade 1 in January and February. The same children were tested again about eight months later in November. A total of 216 children (98 without preschool and 118 with preschool) took part in the study. In every classroom we selected the same number of children with preschool as children without preschool. One of the schools where data was collected was a girls' only school resulting in a higher female ratio in the sample (118 female and 98 males). Only 197 children from the original sample took part in the second measurement due to attrition ($n=19$). Some children had changed schools or moved to other places and could not be located.

2.2 Participants

Participants came from public schools in the city of Lusaka. This delimitation was chosen because 42% of children in Lusaka have been to preschool (MOE, 2009) - a relatively high number compared to other provinces such as Copperbelt Province with 32.3%, Western Province with 4.0 % as well as Northern and North Western Provinces with 4.5 % and 6.1 %, respectively (MOE, 2009; Matafwali, 2013).

2.3 Procedure

The pupils were recruited at the start of the first grade with the help of the teachers who knew whether or not children had been to preschool. Per school we first selected 6 pupils with preschool and then 6 children without preschool comparable in sex and age. The parents gave their informed written consent for the inclusion of their child in the study. Once recruited, the children were subjected to an interview that gave details about the child's home language and the socio-economic status of the child. This interview was done before testing the pupils' basic reading skills and executive functions. During the session, only the assessor was present. Testing took about 45 minutes per child. Pupils were tested again eight months later.

Three trained research assistants who were speakers of Nyanja, the language used in the schools, administered the tests. Two were master's students at the University of Zambia and the other one was a Diploma holder. Assistant researchers received training for two days on test administration preceding the pretest and one day of training preceding the post-test. The first author did the training.

2.4 Measures

2.4.1 Biographical Data Form

A form was completed by the teacher to generate biographical data of each respondent such as personal details (name, age, and sex), language used at home, and whether the child had been to preschool or not.

2.4.2 Home Possession Index

To assess the socio-economic status of the pupils, a 12-item Home Possession Index was completed (see Appendix A). The maximum score for the Home Possession index was 12 and the Cronbach's alpha reliability was .632 ($N=216$). A higher score indicated more home possessions.

2.4.3 The Basic Skills Assessment Tool (BASAT, Nyanja Version)

Basic Skills. The BASAT is a standardized Zambian instrument specifically designed to assess grade 1 and 2 pupils' literacy proficiency. In the assessment at the start of the school year, we focused on alphabet knowledge (including letter naming, letter-sound knowledge, and sound-letter knowledge) and phonological skills (including syllable segmentation, discrimination of initial and ending sounds, and sound blending), a total of 138 items. Cronbach's alpha reliability equalled .982.

Reading and writing. In the assessment at the end of grade 1, we assessed reading and writing skills, involving reading and writing of words and sentences. The reading and writing tasks fell into five groups: two-letter words, one-syllable words, two-syllable words, three-syllable words, and, for reading only, sentences. The maximum score was 27. Cronbach's alpha equalled .782.

2.4.4 Executive Functions

Pencil-Tapping Test (opposite tapping). The pencil-tapping test (opposite tapping) was utilized to measure inhibition as Brooker, Okello, Njagi et al (2010) conducted in Kenya with first-graders. The test is a simple assessment that takes the form of a game played between the child and the assessor. Assessor and child each hold a pencil. The child

is instructed to tap twice when the assessor taps her pencil once, and vice versa, to tap once when the assessor taps twice, thereby inhibiting his or her natural response to mimic the assessor's behavior. After a series of (up to six) practice trials, in which the examiner provided feedback to the child, there were 16 trials without feedback. We assessed the number of correct items and the time it took to complete the task.

Stroop-like Task (opposites). In this task children had to switch rules by responding with the opposite, that is, saying "blue" to a red dog and "red" to a blue dog (Beveridge, Jarrold, & Pettit, 2002). The task consisted of 96 trials distributed over four conditions (saying boy for girl; blue for red; green for yellow and big for small) in which demands on working memory (remembering the color of one or two dogs) and inhibition of the most obvious response (e.g., saying "blue" to a red dog) varied. The test resulted in a maximum success score of 96. We also assessed the time it took to complete the task.

Aggregate measure. Principal component analysis (PCA) resulted in one component explaining 42.71% of the four scores. Component loadings ranged from .30 to .83. The distribution of the variable was normal. A higher score indicated better executive skills.

2.4.5 Pattern Reasoning Test

Nonverbal cognitive skills were assessed as an indicator of intellectual potential. As a measure of nonverbal cognitive skills, a set of items similar to the items used in the Pattern Reasoning subscale of the Kaufman Assessment Battery for Children (K-ABC). The K-ABC has been applied in Kenya, Uganda and Zambia (Bangirana et al. 2009; Matafwali, 2010). The children were shown a series of stimuli forming a logical linear pattern with one stimulus missing. The child was asked to choose the missing stimulus from 4 to 6 options at the bottom of the page. Scores ranged from 0 to 16. Cronbach's Alpha equaled .80 ($N= 216$).

3. Results

3.1 Whether Children with and without Preschool Differ on Background and Outcome Variables.

As Table 1 shows children with a preschool background and those without preschool differed in home possessions, age and intelligence ($d=.29$). Children with a preschool background were on average younger ($d= -.29$) and had higher scores on home possessions ($d= .44$), indicating that children who started school late did not attend preschool and that children attending preschool were from more affluent families. Children with preschool background outperformed their peers in basic cognitive skills, including basic literacy skills ($d= .29$) and non-verbal intelligence ($d= .29$) at the start of grade 1. They were also more advanced in executive functioning ($d= .18$) but this difference was not significant. At the end of the first year, there were no bimodal effects of preschool.

Table 1. Differences on background and target variables between children with preschool background and children without preschool and effect sizes

Measure	No Preschool	Preschool	Preschool-No Pre
	<i>M (SD)</i>	<i>M (SD)</i>	<i>d</i>
Age	3.55(1.38)	3.17(1.24)	-.29*
Sex (% F)	.52(.50)	.57(.50)	.10
Home possessions (max = 12)	8.93(1.68)	9.62(1.44)	.44***
Nyanja speaking (%)	.55(.50)	.67(.47)	.25
Nonverbal. Intelligence	5.17(3.06)	6.13(3.61)	.29*
Executive Functions ^a (start Grade 1)	-.10(1.07)	.08(.94)	.18
Basic skills ^b (start Grade 1)	-.16(1.02)	.13(.96)	.29*
Reading/writing ^b (end Grade 1)	.07(1.06)	-.06(.95)	-.13

* $p < .05$. *** $p < .001$. ^a Factor scores. ^b z-scores.

3.2 Does Preschool Promotes a Head Start in First Grade?

In multivariate analyses in order to test effects of preschool on literacy skills and executive functions at the start of grade 1, we controlled for home possessions, nonverbal intelligence, and age that are all related to preschool. After controlling for these variables, preschool predicted a small non-significant part of the variance in basic literacy skills, meaning that there were only small effects of preschool on alphabetic knowledge and phonological skills beyond differences resulting from differences in nonverbal intelligence (see Table 2).

Table 2. Predicting basic literacy skills at the start of grade 1 controlling for age, home possessions and nonverbal intelligence ($R^2 = .18$)

Step, Predictor	ΔR^2	B (final model)
1. Age	.001	.009
Home possessions		.024
2. Nonverbal intelligence	.049	.205**
3. Preschool	.012	.112

Regressing the same set of variables on executive functioning at the start of the year revealed a positive though not significant effect of preschool, indicating that preschool did not strongly promote executive functions. Our findings show that whether or not they had been to preschool, older children had better regulatory skills as indicated by their higher scores on the executive function tasks (see Table 3).

Table 3. Predicting self-regulation at the start of grade 1 ($R^2 = .08$)

Step, Predictor	ΔR^2	B (final model)
1. Age	.060	.249***
Home possessions		.091
2. Nonverbal intelligence	.010	.086
3. preschool	.008	.095

3.3 Does a Head Start in First Grade Facilitate Learning to Read?

Bimodal correlations revealed that executive functions and basic literacy skills at the start of grade 1 that predicted reading and writing skills at the end of first grade were related to nonverbal intelligence or age (see Table 4). We used a multivariate analysis to test effects of preschool and skills at the start of first grade on reading and writing proficiency at the end of first grade. We regressed reading and writing at the end of grade 1 on basic literacy skills, executive functions, age, nonverbal intelligence, home possessions, sex and familiarity with Nyanja.

Table 4. Bivariate correlations between executive functions, literacy skills and background variables

	Sex	Age	Home p	Intell	Nyanja	EF _{start}	BS _{start}	R & W
Sex	----							
Age	-.006	----						
Home possessions	.102	-.239	----					
Intelligence	-.004	.107	-.059	----				
Nyanja	-.107	.059	-.135	-.050	----			
BS _{start}	.057	.009	.034	.220	.016	.370	----	
R & W	-.093	.077	-.134	.303	.015	.248	.554	----

All r^2 's $\leq .135$ are significant $p < .05$

BS = Basic Skills; R & W = Reading and Writing.

Both executive functions and basic literacy skills at the start of grade 1 were, predictors for the children's reading and writing proficiency assessed at the end of first grade when controlling for age, home possessions nonverbal intelligence, familiarity with Nyanja and attending preschool. Because, according to prior studies, learning to read in first grade is related to familiarity with the language of instruction - Nyanja in Lusaka - we entered familiarity with Nyanja as control variable. Literacy skills including alphabetic knowledge and phonological skills at the start of the year were stronger predictors of reading and writing after one year of instruction than executive functions. As is shown in Table 4, basic literacy skills are significant predictors while executive functions are marginally significant. One remarkable finding is that, after entering basic literacy skills and executive functions assessed at the start of grade 1, preschool caused a negative effect on reading and writing proficiency after one year of reading instruction.

There was no main effect of speaking Nyanja on reading and writing after one year of instruction. However the interaction Nyanja-speaking and basic skills at the start of grade 1 was significant, which indicates that Nyanja-speaking children benefited more from reading instruction in grade 1 especially when they were rather

proficient in basic literacy skills at the start of grade 1 as is shown in Figure 1. Apparently those pupils who were able to practice advanced reading skills in first grade particularly benefited from familiarity with the language in which reading skills were practiced. As pupils were scoring at a lower level on basic skills (alphabetic skills and phonemic awareness), familiarity with the language of instruction did not make a difference for efficacy of instruction in first grade.

Table 4. Predicting reading and writing skills at the end of grade 1 ($R^2 = .40$)

Step, Predictor	ΔR^2	B (final model)
1. Age	.019	-.050
Home possessions		-.090
2. Nonverbal intelligence	.339	.218***
Executive functions		.187†
Basic literacy skills		.338***
3. Nyanja-speaking	.028	-.133
Preschool		-.173**
4. Nyanja*Basic skills	.017	.295*
Nyanja*Executive functions		-.140

Notes. All variables were standardized. † $p < .1$. * $p < .05$. ** $p < .01$. *** $p < .001$

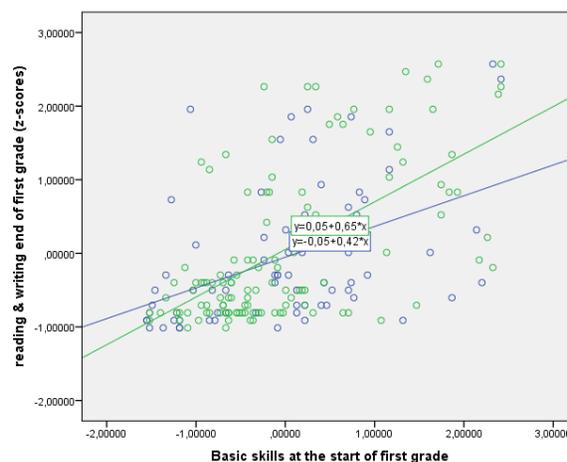


Figure 1. Children who are Nyanja speakers and more advanced in basic literacy skills (green line) benefited especially from reading instruction in first grade.

4. Discussion

4.1 Efficacy of Zambian Preschools

Regarding the differences between the two groups on predictors of academic performance in first grade, it was expected that children with preschool education would perform better than those without preschool. We indeed found that the two groups significantly differed in basic literacy skills, in particular alphabetic knowledge, in favour of children attending preschool but our analyses did not reveal strong evidence that this effect results from attending preschool. When we controlled for nonverbal intelligence and age in multivariate analyses, the difference in favour of preschool decreased indicating that the preschool effect mainly resulted from background factors such as intelligence. Findings do not support the expectation that preschool contributes to the precursors of literacy probably because the preschools do not familiarize children with emergent literacy skills in the Zambian language of instruction. In so far as preschool influenced children's executive functions at the start of first grade, the correlations were positive, albeit non-significant. Age was the strongest predictor of executive functioning meaning that older children are more successful in inhibiting an automatic response. Overall, we did not find strong evidence for effects

of preschool on children's executive functioning when the focus is on inhibitory skills as in the assessments used in the current study.

Some Zambian preschools are like day care centres where children are taken care of while their parents are attending other businesses. It is therefore possible that activities in these preschools do not prepare children for learning to read in elementary classrooms thus explaining the very moderate effects of preschool on basic literacy skills and executive functions. While past research has demonstrated that preschool prepares children for learning to read in first grade (Pretorius & Ribbens, 2005), this does not apply to most Zambian preschools. Thus unlike children in Western societies where children who are exposed to preschool are expected to be more advanced compared to those who are not exposed to preschool, the majority of Zambian children that attend preschool seem to be deprived of the opportunity to practice precursors for learning to read in first grade and as such most of them enter school without the requisite skills. The use of English as language of instruction in preschool may cause the negative effects. Teaching children in English does not contribute to emergent literacy skills in the Zambian language of instruction. In line with the theory of emergent literacy, children need to be familiarized with songs, rhymes and stories in the Zambian language of instruction.

Children who went to preschool came from homes where they had more home possessions than those who did not go to preschool and they were on average younger. The explanation may be that if children are from homes with more home possessions, their parents are more able to pay for preschool whereas parents from homes with fewer home possessions may not be able to afford to send their children to preschool (Ramey & Ramey, 1998). According to the legal age for starting school in Zambia the majority of children with preschool were in the age range of 5 to 8, while there were older children among the classroom peers who had not attended preschool. The Early Childhood Development Project (Zuilkowski, Fink, Moucheraud, & Matafwali, 2012) revealed that participation in Early Childhood Education (ECE) not only improves academic outcomes but also encourages a timely enrolment of children in grade one. Parents whose children have been exposed to ECE are motivated to enrol their children in grade one on time because they interpret their child's participation in school-related activities as evidence of school readiness.

4.2 Basic Literacy Skills and Executive Functions as Requisites for First Grade

Basic literacy skills at the start of first grade predict Zambian children's reading and writing proficiency after one year of reading instruction. The finding that basic literacy skills predict academic success in first grade clearly indicates that some alphabetic and phonetic knowledge at the start of first grade substantially facilitates learning to read and write in first grade. In line with this result, we may expect that children from illiterate families starting school without any exposure to print are more at risk for failure in learning to read than pupils from literate families with some exposure to print. In support of the hypothesis that executive functions are prerequisites for academic achievement in school, there is evidence showing that inhibitory skills predict beneficial effects of reading and writing instruction though the correlation only approached significance.

Basic skills are the strongest predictors of success in first grade when children are familiar with the language of instruction (e.g., Matafwali & Bus, 2014; Tambulukani & Bus, 2012). This makes sense: When children are more advanced in the basic skills for reading and writing at the start of first grade, it is easier for them to understand how to proceed while reading and practice with words and sentences in first grade. As Cunningham and Zibulsky (2014) contended it would be incredibly difficult to try and make sense of written language if the words on the page do not already convey meaning to you. The current results thus add to the theory that familiarity with the language of instruction may become more critical as a factor in explaining reading proficiency across reading development (Matafwali & Bus, 2014; Tambulukani & Bus, 2012).

4.3 Preschool as a Negative Predictor of Academic Development in First Grade

Multilevel regression analysis revealed that the Zambian preschool has a negative effect on reading and writing skills at the end of first grade after we entered basic literacy knowledge and executive functions at the start of grade 1 (Adams, 1990; Bryant & Bradley, 1985; Wagner & Torgesen, 1987). This result aligns with previous studies in Zambia that have also shown that preschool is not beneficial to Zambian children in first grade (Matafwali, 2010). An explanation might be that children learn the English alphabet in preschool while in first grade literacy is taught in a local language that sounds different from English. Just as children get confused when they learn English alphabet names and sounds in preschool, it is possible that children who are exposed to preschool would face the same challenge in phonological skill. The English alphabet names and sounds may interfere with learning to recognize the sounds in Zambian words because their sound is different.

The question is why is the same language of instruction not used in preschool and in first grade. The Zambian government recognizes the need to change the policy and use a local language as the language of instruction in preschool (MOESVTEE, 2012). In the same vein, the government stimulates public schools to annex preschools within their system and has deployed preschool teachers to public schools. The variety of languages may confuse the process of learning to read and fail to contribute to precursors of literacy. It is important that preschool environments build on the songs, rhymes and stories in the child's familiar language in order to succeed in promoting precursors for literacy development and to prepare children for successful transition into elementary grades. This study thus agrees with Matafwali (2010) who observed that the current practice where preschools are promoting the use of English is in contrast with the Zambian government's language policy and might be a source of confusion for majority of the children when they enter first grade in public schools.

4.4 Limitations and Future Directions

As the choice to participate in preschool was not under control of the researcher, it cannot be excluded that any effects of preschool are the outcome of other uncontrolled factors. It is, for instance, possible that more literate parents choose to send their young child to preschool and that the preschool group differs from the group not attending preschool in other ways that may also explain any group differences. Therefore generalisation of results may be limited. In this study we found that preschool does not affect basic literacy skills at the start of first grade and has negative effects on the process of learning to read in first grade. The quality of preschools in Zambia needs to be assessed in future research so that activities in preschools can be improved. We also need intervention studies to test whether teaching pre-literacy skills in a local language in preschool can enhance literacy skills in the first grade.

Acknowledgements

The research has been made possible by the Lolle Nauta Foundation in the Netherlands. The foundation's aims are to stimulate the study of education, developmental psychology and child and family studies at African universities.

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Appendix A

Home Possession Index

- Do you have a television in your home?
- Do you have a radio in your home?
- Do you have a stove at home?
- Do you have electricity at home?
- Do you have running water at home?
- Do you have a flushable toilet?
- Do you have a car at home?
- Do you have at least two sets of clothes?
- Do you have at least one pair of shoes?
- Do you have a bed with a mattress to sleep on?
- Do you live in a house with cement or tile floors?
- Crowdedness of residential living area