Early Childhood Development:

Preschool or No Preschool?

A Baseline Study on the Cognitive and Social-Emotional Development of Preschool and Non-preschool Children in Rural Townships in Dennilton, South Africa.

Master Thesis

Project: Preschool project Dennilton

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Aim: Numerous children in developing countries fail reaching their development potential. A lot of children in rural South Africa experience retention during primary school, which can contribute to intergenerational transmission of poverty. Preschool in the early years can reduce this problem. The aim of this study is gaining knowledge on the current cognitive and social-emotional level of the children to support the importance of preschool education. **Method:** The study included 84 participants (mean age: 4.06 years, *SD*: .91) from townships in the Dennilton area, South Africa, who participated in a preschool (*N*=61) or not (*N*=23). Cognitive development was measured by the AWMA, Visual Search, Shape Stroop and PPVT. Social-emotional development was measured by the BSQ and SDQ, and finally BMI was included. **Results:** In general, cognitive development was higher for children in the preschool. Marginal differences were found for social-emotional development. BMI had a neglectable influence on cognitive and social-emotional development. **Discussion:** This study stresses the importance of preschool education in rural townships of South Africa, because it has a positive influence on cognitive development, reducing the chances of retention in primary school. Future research should take quality of preschools in consideration and be aware to have a sufficient sample for more conclusive results.

Keywords: Early childhood development, preschool, rural, townships, South Africa.

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Introduction

Many children under the age of five in developing countries seem to fail in reaching their potential in development. Most of these children live in Asia and sub-Sahara Africa. Due to exposure to multiple risk factors, such as poverty, malnutrition, poor health, and an unstimulating home environment their cognitive-language and social-emotional development is negatively affected (Grantham-McGregor et al., 2007). The cognitive development in the preschool period, from birth until the age of five or six is very important (Shonkoff & Phillips, 2000), because of the rapid development of the brain through neurogenesis, axonal and dendritic growth, synaptogenesis, cell death, synaptic pruning, myelination and gliogenesis (Blakemore & Frith, 2006; Thompson & Nelson, 2001). The different ontogenetic processes occur at different times and build on each other. A disruption in one of these processes can have long-term effects on the brain (Thompson & Nelson, 2001). In this preschool period the basis for personal, social and intellectual functioning is established (Shonkoff & Phillips, 2000). Moreover, Wicks-Nelson and Israel (2006) suggest, that despite the openness and flexibility of the brain, development potential declines with age. In addition, for developing countries it seems that the early development is a strong determinant for future school progress (Blair, 2002; Currie & Thomas, 1999; Feinstein, 2003; Pianta & McCoy, 1997). Due to a limited development, these disadvantaged children seem to be less educated, have poorer cognitive functioning, are less productive in later life and are more likely to transfer poverty to the next generation (Grantham-McGregor et al., 2007). In rural South Africa many children experience retention during primary school (Liddell & Kemp, 1995). These children especially have difficulties with succeeding in the first Grade (Morris, 1993, as cited in Liddell & Rae, 2001). When the development in the preschool years of children in South Africa is optimized this could lead to less retention, more education, a more productive life and subsequently to a higher well-being and performance of the population as a whole (Ertem, 2004). Knowledge on the current cognitive and social-emotional level of the children is needed to support and determine focus points of future intervention. Gaining information about the cognitive and social-emotional development of children in these preschools can contribute to the establishment of preventions that will help children reach their developmental potential. This study is the start of a longitudinal research, which intends to establish intervention in preschools in rural townships of South Africa.

The aim of this baseline study is to gain knowledge on cognitive and social-emotional development of preschool children in rural townships of South Africa. We will compare the

level of cognitive development en social-emotional development of children, 3-6 years old, attending a preschool, with children, 3-6 years old, from the same areas who are not attending a preschool in a rural township area in South Africa. Data will be collected in Dennilton, a township area in South Africa, approximately 200 kilometres from Johannesburg (Elandsdoorn Foundation, nd.) and will focus on the Ndlovu Care Group preschools. The Ndlovu Care Group is an organisation that started a project in Dennilton. They aligned their goals with the Millennium Development Goals (United Nations Developing Programme, n.d.). To accomplish this, the organisation divides their activities into Community Health Care and Community Development Programs. In addition, the Ndlovu Care Group created preschool care centres, in order to create awareness, to provide care and to educate (Ndlovu Care Group, nd.).

In this study development is perceived as "patterns of change over time which begin at conception and continue throughout the life span" (Keenan, 2002, p. 4). Development does not occur by itself, but is an interaction between biology and experience and the developmental course can be modified through interventions (Shonkoff & Phillips, 2000). Development occurs at several levels: physical, social-emotional, and cognitive (Berk, 2009). We will focus on the cognitive and social-emotional development, because links have been suggested between the development of these areas and social and academic competence in school (Blair, 2002).

Cognitive development refers to alterations in "intellectual abilities, including attention, memory, academic and everyday knowledge, problem solving, imagination, creativity, and language". Social-emotional development can be described as "changes in emotional communication, self-understanding, knowledge about other people, interpersonal skills, friendships, intimate relationships, and moral reasoning and behaviour" (Berk, 2007, p. 9). Social-emotional and cognitive development concern changes in these areas over time. Nevertheless, in this study development will be defined as the level of development at a certain moment, because the available time to conduct this research is limited. Cognitive development can be distinguished in separate dimensions, namely, executive functions and language development. The first dimension, executive functions, consisting of the working memory, attention and inhibitory control, is selected, because it covers basic cognitive processes that organize thought resources toward a desired condition. Moreover, the preschool period seems to be an important time for development of executive functions (Blair, 2002; Garon, Bryson, & Smith, 2008). Inhibition could be described as "the ability to ignore

distraction and stay focused, and to resist making one response and instead make another". Working memory is defined as "the ability to hold information in mind and manipulate it". The last function, attention is identified as "the ability to flexibly switch perspectives, focus of attention, or response mapping" (Diamond, 2006, p. 70). The second dimension, language development is selected, because of the strong relation between language development and acquirement of reading skills (Ramey & Ramey, 2004). In the present research, language development refers to the language level at the time of the measurement. Language will be divided into two variables: the lexicon (i.e., the expressive language) and the verbal short-term memory. The lexicon will be measured in English, because this can give an indication for school readiness. This is important, because these children learn to read and write in English when they attend primary school. Certain knowledge of English is necessary before they can learn to read and write properly. Moreover, tests for the lexicon of Zulu and Sotho speaking children from the targeted age are not yet developed. The verbal short-term memory is selected, because it plays an important role in acquiring native and second language skills (Messer, et al., 2010).

Despite the lack of knowledge on the quality of the Ndlovu preschool, the children in the preschool spend a part of their time in an environment with other children, where they play with other children and are encouraged in several ways (i.e. they draw, they sing, they have exhibit social behaviour) which probably influences the development of these children positively (Bronfenbrenner, 1977). Also in other developing countries an influence of preschool attendance has been found (Aboud, 2006; Berlinski, Galiani & Gertler, 2006; Boocock, 1995; Cueto & Diaz, 1999 as cited in Engle et al., 2007; Jamarillo & Tietjen, 2002). For example, in Bangladesh Aboud (2006) found that preschool education increased school readiness and that the social play between preschool children en non-preschool children differed. Children in the preschool exhibited more interactive play and had more conversations. In Peru children scored higher on math and language when they attended a formal or non-formal preschool in comparison with children who did not attend a preschool (Cueto & Diaz, 1999, as cited in Engle et al., 2007). Moreover, Boocock (1995) summarised the results of several studies about the influence of preschool. This indicated that preschool influences cognitive development and school success. Moreover, it seemed that preschool education could be a protecting factor against several risk factors. The social-emotional development of the preschool children might be healthier, due to declination of risk factors. Consequently, a higher cognitive development in preschool children is expected in

comparison with children who do not attend a preschool. Furthermore, we expect to find a difference in social-emotional development between both groups of children.

Besides the influence of preschool there are several other factors that influence developmental outcomes in children. According to Bronfenbrenner's ecological model (1977), development does not occur by itself, but is influenced by its environment. The model includes four levels of the ecological system that influence the development of children. First, the micro system which influences the child directly and on which child can react directly. Second, the meso system which describes the interaction of micro systems. Third, the exo system that influences the meso system. Last, the macro system which is not a specific system contains facets like the law, culture, and religion. These facets have control or give direction to the lower systems. Bronfenbrenner's theory highlights the importance of studying contextual factors in explaining development of children in rural areas in South Africa. Despite the knowledge of presumable influences of other systems (e.g., parenting, neighbourhood, teacher-parent relationship, policy), this research will only take the undernutrition of the children into account, because undernutrition is apparent in rural South Africa. Undernutrition could be seen as micro level influence, because the parents feed their children. However, undernutrition can also be perceived as an influence no macro level, when a lack of food is for example due to social policy. Walker and colleagues (2007) considered evidence which link undernutrition, defined as growth, with child developmental outcomes. They stated: "The presence of cognitive and educational deficits in stunted children is a consistent and robust finding, although the size of the deficit varies across studies." (p. 146). Moreover, they found in their review that stunting and underweight in young children is associated "with apathy, less positive affect, lower levels of play and more insecure attachment." (p. 146). In addition, the lack of attachment to a consistent caregiver can have a negative effect on the development of the child (Siddiqi, Irwin, & Hertzman, 2007). Parents of the children who attend the Ndlovu preschool have to pay a fee of 80 Rand a month (which is around 8 €). Some parent might not be able to pay this fee. Thus, children in the preschool might come from families who have more money. Moreover, children attending preschool receive at least two meals a day at this preschool. Consequently, it might be that children in the preschool are better nourished than children who are not attending the preschool. To give a more realistic view on the possible difference in development between the two different groups it is important to control for undernutrition or see whether there is an influence of

undernutrition on development. In this research undernutrition will also be defined as growth, and therefore, length and weight will be considered.

Overview of research questions

In consideration of the findings in the previous part the following research questions are proposed: 1) Is the cognitive and social-emotional development of children aged two to six who attend the Ndlovu Care Group preschool different from children from two to six who do not attend a preschool? 2) Is the cognitive and social-emotional development of children aged two to six in Dennilton influenced by undernutrition? 3) Is the influence of undernutrition different for children who attend the Ndlovu Care Group preschool from children who are not attending a preschool?

Concerning the theoretical arguments in the introduction, the following hypotheses are proposed for the first three questions: 1a) The cognitive development of children who attend a preschool is higher as compared to children who do not attend a preschool. 1b) Social-emotional development differs between children who attend a preschool and children who not attend a preschool. 2) The cognitive and social-emotional development of children from three to six in Dennilton is negatively influenced by undernutrition. 3) The development of children who do not attend a preschool is influenced more by BMI compared to children who attend a preschool.

Method

Participants.

This study focused on children from two to six years old who live in Dennilton, a rural township area in South Africa. A group of these children attended one of the two preschools of Ndlovu Care Group in Dennilton. The other group lived in Dennilton in the same area the preschools were located, thereby controlling for possible contextual differences. The children were selected by a convenience sample, because there is hardly any registration of residents in Dennilton. The children in the preschools were tested during visits at the preschools. The children around the preschool were approached through community workers of the Ndlovu Care Group.

The sample included 84 participants (mean age in years: 4.06; *SD*: 0.91). From these children 61 (mean age in years: 3.83; *SD*: 0.92) attended a Ndlovu Care Group Preschool and

23 (mean age in years: 4.14; SD: 0.89) did not. There was no significant difference in age between both groups.

Dependent variables

Assessment Cognitive Development.

Executive functions. Executive functions is measured by inhibition, attention and working memory. First, inhibition was measured by the Shape Stroop (Garon et al., 2008). In this test the children saw two different big animals; in these big animals a different small animal was placed. The child was asked to point to a specific small animal. However, from the same animal there was also a big one. When a child pointed toward the big animal instead of the small one, the child scored lower on inhibition. Before the test started, children had to perform the test item. In the test items children learned about big and small and the different kind of animals. The test only started when the child could recognize big/small and the different kind of animals. The value of the Cronbach's α was found to be .68, which can be categorised as moderate to high (Field, 2005).

Second, attention was measured by the Visual Search (Enns & Cameron, 1987). The Visual Search had three test items. In these test items children had to find the elephants as fast as possible. The elephants were hidden between other animals, which had the same colour and some feature similarities. The children had one minute to find as many elephants as possible. The more elephants the children found (maximum of three per test), the higher the children scored on attention. In addition, the time (in seconds) a child needed to find an elephant was measured. The value of the Cronbach's α for the number of elephants that were found was established to be .90, which can be categorised high (Field, 2005). The time in which an elephant was found had a Cronbach's α of .11, which can be categorized as low (Field, 2005).

Third, working memory was tested by three tests of the Automated Working Memory Assessment (AWMA) (Alloway, 2004; Alloway et al., 2008) the digital recall, non-word recall and the odd one out. These tests have been selected, because they are appropriate for the age category. Additionally, Campbell and colleagues (1997) suggest that a cultural bias in these kind of tests was reduced, because the test is based on the process instead of knowledge. Moreover, by using non-language based tests, the language bias will be avoided as much as possible. Additionally, Alloway and colleagues (2008) found that the AWMA was reliable and for measuring the working memory. For working memory, the three tests will be described separately. In the digit recall children had to repeat digits. The number of digits

increased per round. When a child repeated four times the correct order and numbers in the six chances he has, he went to the next round. When the child gave three wrong answers the test stopped. The more numbers and times a child repeated the digits correctly the higher he scored on working memory. The non-word recall had the same principles as the digit recall, but consisted of non-words instead of digits. These non-words were construed from an existing list. However, to avoid a language bias the words were first reviewed by three native speakers of Zulu and Sotho. It was discussed, whether these word existed in their language and when there was a disagreement in what they heard they listened to it again until they came to an agreement. The last test that was used was the odd one out. The odd one out consisted of two aspects. The recognition of the odd shape. There are three boxes with three shapes; one of these shapes is different. The child had to point out the odd shape. The second aspect concerns the working memory. The child had to remember in which boxes he saw the odd one out and had to point to the right boxes in the correct order as he saw the odd shapes when he saw the empty boxes. Every round the child had to remember one more odd shape. When a child made three mistakes the test stopped.

Language development. The language development was be measured by the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 1997) and the AWMA, non-word recall (Alloway, 2004; Alloway et al., 2008). The PPVT was used to measure the lexicon. The use of this test came from the understanding that: "Children use gestures, sounds, words, or sentences (including sign language and augmentative or alternative communication) to convey wants and needs or to express meaning to others" (McConnel et al., 2003, p. 225). In previous studies, the PPVT was found to be reliable for the age group of this research. Also the content validity of the PPVT was found to be high (Dunn & Dunn, 1997). In the PPVT the child heard an English word and the child had to point to the picture, one of four, that matched with the word. The children started with set one. When the children had less than 8 mistakes they went on to a next set, otherwise the test stopped. When the test stopped the number errors were deducted of the number of items that had been done, 12 per set. This ended up in a raw score. The PPVT also provided a norm score based on a different population, but to avoid bias only the raw scores were used. The verbal short-term memory was measured by the non-word recall (Messer et al., 2010), the same test as discussed in the working memory part was used.

Assessment of Social and emotional development. The social and emotional development was measured by McDevitt and Carey's Behavioural Style Questionnaire (BSQ) (1978), because of its cross-cultural validity (Super et al., 2008). In previous research the BSQ was found to be reliable with a Cronbach's α of .84 for the total instruments. The lowest Cronbach's α's were found for Threshold (.47) and Regularity (.48). The remaining scales had a sufficient Cronbach's α of at least .60 or higher (McDevitt & Carey, 1978). In this study, the questionnaires were conducted by one of the primary caregivers. The questions could be answered in a six-point scale ranging from 1 (almost never) to 6 (almost every time). Firstly, the questionnaire was made available in English and in Sotho. Secondly, the questionnaire was reduced to 45 questions instead of the original 100 to make it more cultural sensitive. 15 questions were not relevant for this context, because of other customs, available material and school attendance (i.e., the meals were less structured - not on the table and meals were combined, because of a lack of food -, they do not have books or toys or do structured games and a group of the children does not attend school). Another problem was that the questionnaire was too long for this group. A former researcher in this area stated that the length of my questionnaire would reduce the quality and therefore advised to shorten it. After the deletion of the irrelevant question every second question within a construct was deleted. Nine items had to be recoded. The questions led to nine constructs concerning the division of temperament according to Thomas and Chess (1977). The Cronbach's α's for these constructs were; Activity (five items), .24; Regularity (five items), .63; Adaptability (six items), -.03; Approach/Withdrawal (five items), .13; Intensity (six items), .54; Mood (six items), .31; Persistence (four items), .29; Distractibility (four items), -.25; and Threshold (five items), -.02. Only the scale which measured regularity was reliable.

A second questionnaire to measure the social and emotional development was the Strengths and Difficulty Questionnaire for 0-3 years old (SDQ). This questionnaire was used for all the children between 2 and 6, so there would be an equal measurement for all the children instead of two different questionnaires. Moreover, the SDQ has been found to be useful, economical and a good measurement in several settings and researches (Goodman, 1997; Hawes & Dadds, 2004; Klasen et al., 2000; van Widenfelt et al., 2003). Moreover, the SDQ has found to be valid in various settings (Woerner et al., 2004). This questionnaire consisted of 25 questions concerning the child's behaviour. The questionnaire was conducted by one of the primary caregivers. The questions had to be answered with 1 (true), 2 (partially true) or 3 (not true). The first question of the questionnaire was eliminated, because 48 of the

76 parents did not fill in this question. Four questions had to be recoded. The 24 questions lead to the following 5 constructs of 5 items – except the pro-social scale consisting of 4 items - with the following Cronbach's α's: Emotional Symptom, .60 – after deletion of question 13; Conduct Problem, .60; Hyperactivity, .19; Peer Problem, .06; Pro-social, .68. Emotional symptom (*N*=69), Conduct problem (*N*=74) and Pro-social (*N*=72) seem to be reliable.

Independent Variables

Preschool. Whether a child did or did not attend a preschool was noted with 0 when a child did not attend a preschool and 1 when a child attended a preschool.

Testability. Whether a child could be tested was noted with 0 for not testable and 1 for testable.

Undernutrition. Undernutrition was measured in using the Body Mass Index (BMI) (World Health Organisation, n.d.). Weight, measured in kilograms, was divided by length, measured in meters, squared.

Procedure

All the tests, except for the Peabody Picture Vocabulary test, were computer based. Due to lack of familiarity with computers in this area, the tests were transformed to paper pencil test to avoid bias. Testers where trained to conduct the data collection. Other confounding factors were reduced as much as possible: the children in the community knew the community worker and tests could be conducted without the attendance of one of the researchers, to reduce the bias out of fear for white people. Also, the children in the preschools were acquainted with the teacher. To compare the groups, external differences were reduced to a minimum. For example, knowledge that was necessary in some tests was practiced with the children until they mastered it. Also, other tests were process based and had no knowledge base. Moreover, children were always in a environment in which they were already acquainted and distractions were reduced to a minimum.

To answer the research questions, Hierarchical Regression Analyses and a Chi-square Analyses were used. For the Hierarchical Regression Analyses three models were estimated. Model 1 adopted the control variables age and gender. Model 2 also included the main effects BMI and Preschool. Model 3 added the interaction effect between BMI and Preschool. All dependent variables were tested separately. Although this leads to some loss of reliability, it was possible to maintain as much respondents as possible in the separate analyses. Chi-square

analyses were used to explain the variance on the dichotomous dependent variable testability. Due to a lack of research in this area on this subject, tests were conducted two-sided. Some of the children did not respond on some cognitive tests due to non-testability. In the first analyses missing values due to non-testability were imputed with zero, in the second analyses no data was imputed. Both analyses were interpreted and compared. The analyses without imputation underestimate the effect of preschool and the analyses with zero imputation overestimates the effect of preschool. The overestimation is due to the premises that all the children would score zero if they did not respond. The underestimation is due to the deletion of a specific group of children who lack the skills to do the task. The true differences between preschool children and children who not attend a preschool will be somewhere in the middle of both analyses.

Results

Descriptive statistics and correlation analyses on dependent variables

Table 1 and 2 show the mean, standard deviation, number of observations and correlations of the independent variables for data with imputation (See Table 1) and data without imputation (See Table 2). First the significant correlations of data with imputation will be discussed. For non-preschool children inhibition correlated positively with the digit recall (r = .48), the non-word recall (r =.50) and lexicon (r = .55). When non-preschool children scored higher on inhibition they also scored higher on the digit recall, non-word recall and PPVT. For preschool children a negative correlation between inhibition with all the working memory tests (r ranging from -.26 to -.30) was found. When preschool children scored high on the inhibition test they scored lower on the short term working memory tests. Furthermore, when children did not attend a preschool attention correlated positively with the scores on the digit recall (r = .56). When children attended a preschool attention correlated positively with the scores on the non-word recall (r = .62), the scores on the odd one out (r = .41, r = .43) and the lexicon (r = .29). Additionally, for both preschool and non-preschool children a higher score on the digit recall was an indication of a higher score on the non-word recall (respectively, r = .53, r = .92), the scores on the odd one out (respectively, r = *.38* and r = .46, r = .46 and r = .54) and the lexicon (r = .35, r = .61). Also, a positive relationship between the non-word recall and the lexicon (preschool; r = .35, non-preschool; r = .79) was found for both group. Moreover, only for preschool children an association was found for

Table 1

Correlations, Mean, SD, N for dependent variables divided for preschool and non-preschool children with 0 imputation

Measure	1.	2.	3.	4.	5a.	5b.	6.	7.	8.	9.	10.	M_n	SD_n	N_n
1. Inhibition	-	.21	.48*	.50*	.36	.39	.55**	-.06	.09	.04	-.12	1.28	.93	23
2. Attention	-.05	-	.56**	.43	.36	.34	.26	-.14	.34	.36	.09	3.48	3.99	23
3. Digit Recall	-.30*	.36	-	.92**	.46*	.54*	.61**	-.42	-.29	-.03	.46*	12.16	9.33	19
4. Non-word Recall	-.27*	.62**	.53**	-	.33	.41	.79**	-.44	-.39	-.10	.34	7.26	5.81	19
5a Odd One Out Precision	-.26*	.41**	.38*	.50**	-	.80**	.36	-.30	-.42	-.22	.24	1.00	0.95	19
5b Odd One Out Memory	-.27*	.43**	.46**	.47**	.93**	-	.18	-.23	-.26	-.11	.08	0.68	0.95	19
6. Lexicon/PPVT	-.14	.29*	.41**	.35**	.39*	.39**	-	-.02	.08	.23	-.04	3.04	2.77	23
7. Regularity	.13	.28	-.06	.09	.12	.10	-.17	-	.19	-.08	-.39	4.54	0.87	21
8. Pro-social Scale	-.06	.00	-.08	-.05	.04	.05	-.11	.31*	-	.62**	-.22	2.24	0.60	21
9. Emotional Scale	-.16	.20	-.15	.07	-.24	-.11	.12	.00	-.29	-	.03	1.86	0.50	21
10. Conduct Scale	-.04	-.05	.18	.15	.28	.31*	.03	.00	-.32*	.19	-	1.96	0.34	23
M_p	1.58	7.85	19.97	13.68	5.79	3.03	13.69	4.03	2.45	1.82	1.61	-	-	-
SD_p	0.49	2.28	4.42	4.26	5.72	2.94	9.51	1.08	0.54	0.51	0.50	-	-	-
N_p	60	60	61	60	61	61	61	46	48	45	48	-	-	-

Note. Results for children who do not attend a preschool are presented above the diagonal; Result for children who attend a preschool are presented below the diagonal

* p <.05. ** p < .01.

Table 2

Correlations, Mean, SD, N for dependent variables divided for preschool and non-preschool children without imputation

Measure	1.	2.	3.	4.	5a.	5b.	6.	7.	8.	9.	10.	M_n	SD_n	N_n
1. Inhibition	-	-.50*	-.29	-.06	-.47	-.19	.13	.22	.04	-.02	-.22	1.73	0.60	17
2. Attention	-.31*	-	.45	.21	-.08	-.04	-.09	-.08	.43	.43	.14	4.71	3.96	17
3. Digit Recall	-.28*	.46**	-	.68**	-.09	-.14*	.22	-.35	-.09	.39	.60*	16.5	6.60	14
4. Non-word Recall	-.41**	.52**	.65**	-	-.25	-.34	.58*	-.34	.05	.19	.10	10.62	3.48	13
5a Odd One Out Precision	-.33*	.38**	.48**	.49**	-	.56	-.03	.08	-.80*	-.85**	.22	1.90	1.10	10
5b Odd One Out Memory	-.33*	.40**	.40**	.46**	.92**	-	-.31	.25	-.34	-.46	-.10	1.30	0.95	10
6. Lexicon/PPVT	-.21	.26	.41**	.32*	.36**	.32*	-	.22	.23	.38	-.15	3.89	2.54	18
7. Regularity	.03	.21	-.06	-.01	.02	.00	-.17	-	.19	-.08	-.39	4.54	0.87	21
8. Pro-social Scale	-.06	.00	-.08	-.05	-.14	-.00	-.11	.31*	-	.62**	-.22	2.24	0.60	21
9. Emotional Scale	-.24	.17	-.15	.04	-.26	-.13	.12	.00	-.29	-	.03	1.86	0.50	21
10. Conduct Scale	-.11	-.13	.18	.10	.41**	.45**	.03	.00	-.32*	.19	-	1.96	0.34	23
M_p	1.61	7.98	19.97	13.91	6.09	3.19	13.69	4.03	2.45	1.82	1.61	-	-	-
SD_p	0.44	2.06	4.42	3.90	5.71	2.93	9.51	1.08	0.54	0.51	0.50	-	-	-
N_p	59	59	61	58	58	58	61	46	48	45	48	-	-	-

Note. Results for children who do not attend a preschool are presented above the diagonal; Result for children who attend a preschool are presented below the diagonal

* p <.05. ** p < .01.

both scores on the odd one out (r = .50, r = .47). Additionally, the precision score for the odd one out was positively correlated with the memory score on the odd one out for preschool (r = .93) and non-preschool (r = .80) children. Furthermore, the memory score of the odd one out related with lexicon (r = .39) and conduct (r = .31) only for preschool children. In addition, for preschool children regularity was positively associated with pro-social behaviour (r = .31). Finally, pro-social behaviour correlated positively with emotional behaviour (r = .62) for non-preschool children and negatively with conduct behaviour (r = -.32) for preschool children (See Table 1).

The model without imputation revealed some alternate results. For non-preschool children, inhibition was negatively associated with attention (r= -.50) and no longer to the digit recall, the non-word recall and lexicon. Also the directions of the r changed for attention and the digit recall. For preschool children was the negative correlation between inhibition and attention (r = -.31) new. Furthermore, for non-preschool children attention is no longer related to the digit recall, also the direction of the r changed. For preschool children attention was no longer associated with lexicon, but attention was positively correlated with the digit recall (r = .46). Moreover, for non-preschool children the digit recall did no longer correlate with lexicon, the correlation with the memory score of the odd one out changed direction (r = -.14) and conduct behaviour (r = .60) related positively. Additionally, the odd one out precision score did not longer relate to the odd one out memory score for the non-preschool. However, the odd one out precision score related negatively with pro-social (r = -.80) and emotional behaviour (r = -.85). For preschool children the odd one out scores now correlated positively with conduct behaviour (r = .41, r = .45).

Besides the correlation between the variables, it was investigated whether children in the preschool differed in several aspects from children who did not attend a preschool. First, it was tested whether preschool and non-preschool children differed in testability with a Chi-square analyses. Children who did not attend a preschool were less testable than children who attend a preschool, χ^2 (1, N = 84) = 10.17; p = .001. Second, differences in BMI between preschool and non-preschool children were investigated with an independent sample t-test. Children who attended a preschool had a lower BMI than children who did not attend a preschool, t (82) = 3.94, p < .001.

Table 3

Lexicon (n = 84), Inhibition (n = 83) and Attention (n = 83) with 0 imputation

	PPVT			Shape Stroop			Visual Search		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Step 1									
Gender	1.54	1.99	.08	.06	.14	.05	.01	.72	.00
Age in Years	3.57**	1.11	.34	-.24**	.08	-.34	1.37**	.40	.36
Step 2									
Gender	1.20	1.77	.06	.03	.13	.03	-.11	.60	-.06
Age in Years	2.53*	1.13	.24	-.36***	.08	-.51	.86*	.39	.23
Preschool	9.34***	2.14	.44	.25*	.16	.17	3.76***	.73	.49
BMI	-.29	.56	-.06	-.09	.04	-.28	-.18	.19	-.10
Step 3									
Gender	1.31	1.77	.07	.02	.13	.02	-.12	.61	-.02
Age in Years	2.42*	1.14	.23	-.35*	.08	-.49	.87*	.39	.23
Preschool	9.81***	2.21	.46	.20	.16	.14	3.73***	.76	.49
BMI	-.46	.59	-.10	-.07	.04	-.22	-.17	.20	-.10
Preschool X BMI	-.85	.99	-.09	.09	.07	.14	.07	.34	.02

Note. PPVT: $R^2 = .12^{**}$ for Step 1; $\Delta R^2 = .21^{***}$ for Step 2; $\Delta R^2 = .01$ for Step 3. Shape Stroop: $R^2 = .12^{**}$ for Step 1; $\Delta R^2 = .12^{**}$ for Step 2; $\Delta R^2 = .02$ for Step 3. Visual Search: $R^2 = .13^{**}$ for Step 1; $\Delta R^2 = .28^{***}$ for Step 2; $\Delta R^2 = .00$ for Step 3

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Cognitive - Working memory: Digit Recall (N=80), Non-word Recall (N=79) and Odd one out (N= 80) with 0 imputation

	Digit Recall			Non-word Recall			Odd One Out Precision Score			Odd One Out Memory Score		
Variable	*B*	*SE B*	*B*	*B*	*SE B*	*β*	*B*	*SE B*	*B*	*B*	*SE B*	*β*
Step 1												
Gender	1.01	1.52	.08	1.29	1.12	.12	-.61	1.06	-.06	-.06	.52	-.01
Age in Years	1.43	.84	.19	2.59***	.62	.44	3.03***	.59	.51	1.74***	.29	.57
Step 2												
Gender	1.07	1.31	.08	1.32	.93	.12	-.48	1.02	-.04	.03	.51	.01
Age in Years	-.05	.83	-.01	1.30*	.60	.22	2.64***	.65	.44	1.63***	.32	.53
Preschool	6.13***	1.68	.39	4.38***	1.12	.35	3.59**	1.30	.28	1.80**	.65	.28
BMI	-.91*	.41	-.27	-.85**	.30	-.31	-.10	.32	-.04	.02	.16	.01
Step 3												
Gender	.82	1.30	.06	1.36	.94	.13	-.35	1.02	-.03	.07	.51	.01
Age in Years	.13	.83	.02	1.26*	.61	.21	2.55***	.65	.43	1.60***	.32	.52
Preschool	5.20**	1.74	.33	4.50**	1.26	.36	4.04**	1.36	.32	1.96**	.68	.30
BMI	-.67	.42	-.20	-.88**	.32	-.33	-.22	.33	-.08	-.02	.17	-.02
Preschool X BMI	1.28	.72	.20	-.17	.53	-.03	-.62	.57	-.12	-.22	.28	-.08

Note. Digit recall: R^2 = .04 for Step 1; ΔR^2 = .27*** for Step 2; ΔR^2 = .03 for Step 3. Non-word Recall: R^2 = .19*** for Step 1; ΔR^2 = .27*** for Step 2; ΔR^2 = .00 for Step 3. Odd One Out Precision Score: R^2 = .27*** for Step 1; ΔR^2 = .09** for Step 2; ΔR^2 = .01 for Step 3. Odd One Out Memory Score: R^2 = .33*** for Step 1; ΔR^2 = .07* for Step 2; ΔR^2 = .01 for Step 3

* p <.05. ** p < .01. *** p < .001.

Table 5

Lexicon (n = 84), Inhibition (n = 83) and Attention (n = 83) without imputation

	PPVT			Shape Stroop			Visual Search		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Step 1									
Gender	1.33	2.00	.07	.01	.09	.01	-.12	.62	-.02
Age in Months	3.88***	1.11	.37	-.31***	.05	-.58	1.36***	.35	.42
Step 2									
Gender	1.10	1.86	.06	.00	.09	.00	-.26	.57	-.04
Age in Months	2.81*	1.18	.27	-.34***	.06	-.64	.96*	.37	.29
Preschool	8.15***	2.34	.37	-.03	.12	-.02	2.63***	.73	.38
BMI	-.36	.65	-.07	-.03	.03	-.12	-.13	.20	-.07
Step 3									
Gender	1.33	1.89	.07	-.02	.09	-.02	-.33	.58	-.06
Age in Months	2.76*	1.19	.27	-.34***	.06	-.62	.98**	.37	.30
Preschool	8.76***	2.53	.39	-.09	.13	-.08	2.38**	.79	.34
BMI	-.35	.66	-.06	-.03	.03	-.12	-.13	.20	-.08
Preschool X BMI	-.91	1.37	-.07	.09	.07	.14	.36	.42	.09

Note. PPVT: $R^2 = .14^{**}$ for Step 1; $\Delta R^2 = .15^{**}$ for Step 2; $\Delta R^2 = .00$ for Step 3. Shape Stroop: $R^2 = .33^{***}$ for Step 1; $\Delta R^2 = .01$ for Step 2; $\Delta R^2 = .02$ for Step 3. Visual Search: $R^2 = .18^{***}$ for Step 1; $\Delta R^2 = .16^{***}$ for Step 2; $\Delta R^2 = .10$ for Step 3

* p <.05. ** p < .01. *** p < .001.

Table 6

Cognitive - Working memory: Digit Recall (N=80), Non-word Recall (N=79) and Odd one out (N= 80)with 0 imputation

	Digit Recall			Non-word Recall			Odd One Out Precision Score			Odd One Out Memory Score		
Variable	*B*	*SE B*	*B*	*B*	*SE B*	*β*	*B*	*SE B*	*B*	*B*	*SE B*	*β*
Step 1												
Gender	.50	1.13	.05	.25	.81	.03	-.10	1.16	-0.09	-.20	.57	-.04
Age in Years	1.68**	.63	.30	2.48***	.46	.55	3.08***	.64	0.51	1.80***	.32	.58
Step 2												
Gender	.51	1.11	.05	.38	.78	.05	-.79	1.16	-.07	-.12	.57	-.02
Age in Years	.92	.70	.17	1.74***	.50	.39	2.75***	.72	.46	1.74***	.35	.56
Preschool	2.10	1.52	.16	1.57	1.06	.15	2.51	1.67	.16	1.05	.82	.13
BMI	-.60	.38	-.21	-.64*	.28	-.26	-.22	.42	-.06	.00	.21	.00
Step 3												
Gender	-.23	10.80	-.02	.35	.80	.04	-.72	1.20	-.07	-.11	.59	-.02
Age in Years	1.15	.66	.21	1.74**	.51	.39	2.74***	.72	.45	1.73 ***	.36	.56
Preschool	-.15	1.61	-.01	1.49	1.18	.14	2.75	1.82	.18	1.10	.90	.14
BMI	-.67	.36	-.23	-.65*	.29	-.26	-.13	.49	-.04	.02	.24	.01
Preschool X BMI	2.43**	.80	.36	.10	.69	.02	-.48	1.42	-.05	-.09	.70	-.02

Note. Digit recall: $R^2 = .09^{*}$ for Step 1; $\Delta R^2 = .08^{**}$ for Step 2; $\Delta R^2 = .10^{**}$ for Step 3. Non-word Recall: $R^2 = .30^{***}$ for Step 1; $\Delta R^2 = .09^{*}$ for Step 2; $\Delta R^2 = .00$ for Step 3. Odd One Out Precision Score: $R^2 = .28^{***}$ for Step 1; $\Delta R^2 = .03$ for Step 2; $\Delta R^2 = .00$ for Step 3. Odd One Out Memory Score: $R^2 = .35^{***}$ for Step 1; $\Delta R^2 = .02$ for Step 2; $\Delta R^2 = .00$ for Step 3

* p <.05. ** p < .01. *** p < .001.

Table 7

Social Emotional Development: Regularity (n=67), Pro-social Scale (n=69), Emotional Scale (n=66) and Conduct Scale (n=71)

	Regularity			Pro-social Scale			Emotional Scale			Conduct Scale		
Variable	*B*	*SE B*	*B*	*B*	*SE B*	*β*	*B*	*SE B*	*B*	*B*	*SE B*	*β*
Step 1												
Gender	-.26	.26	-.13	-.23	1.40	-.21	-.08	.12	-.08	.06	.11	.07
Age in Years	-.09	.15	-.08	-.02	.08	-.04	.06	.07	.12	.04	.07	.08
Step 2												
Gender	-.25	.25	-.12	-.25	.14	-.22	-.09	.13	-.09	.08	.11	.08
Age in Years	.01	.17	-.01	-.03	.09	-.04	.03	.08	.06	.04	.07	.06
Preschool	-.43	.32	-.19	.26	.17	.22	-.11	.15	-.10	-.41**	.13	-.41
BMI	.03	.08	.07	.01	.05	.04	-.04	.04	-.15	-.03	.04	-.41
Step 3												
Gender	-.22	.25	-.11	-.27	.14	-.24	-.09	.13	-.09	.07	.11	.07
Age in Months	-.06	.17	-.05	-.00	.09	-.01	.03	.08	.06	.04	.07	.08
Preschool	-.38	.32	-.17	.23	.17	.19	-.11	.16	-.10	-.42***	.13	-.42
BMI	-.04	.10	-.08	.04	.05	.14	-.04	.05	-.15	-.02	.04	-.07
Preschool X BMI	-.21	.15	-.22	.11	.08	.19	.00	.07	.00	.04	.06	.08

Note. Regularity: R^2 = .02 for Step 1; ΔR^2 = .05 for Step 2; ΔR^2 = .03 for Step 3. Pro-social Scale: R^2 = .04 for Step 1; ΔR^2 = .04 for Step 2; ΔR^2 = .03 for Step 3. Emotional Scale: R^2 = .02 for Step 1; ΔR^2 = .02 for Step 2; ΔR^2 = .00 for Step 3. Conduct Scale: R^2 = .01 for Step 1; ΔR^2 = .14** for Step 2; ΔR^2 =.00 for Step 3

* p <.05. ** p < .01. *** p < .001.

Influence of preschool and BMI on cognitive and social-emotional development

This following paragraphs will discuss the findings of the Hierarchical Regression Analyses. In Model 1, the control variables age and gender were included. Age positively influenced lexicon, attention (See Table 3), the non-word recall and the odd one out scores (See Table 4). This means that the older children scored higher on the tests than younger children. Age influenced inhibition negatively. This means that older children where less capable in inhibiting their reacting (See Table 3). When the dependent variables were not imputed an alteration occurred, age did no longer influence the results on the Digit Recall (See Table 6). Gender had no effect on any aspects of cognitive (See Table 4 and 5) and social-emotional development (See Table 7).

In Model 2 the variables preschool and BMI were included. As expected, preschool education was found to effect lexicon, inhibition, attention (See Table 3) and working memory (digit recall, non-word recall, odd one out scores) (See Table 4) positively. Thus, children who attended a preschool performed better on the attention test and found more elephants in one minute that children who did not attend a preschool. The model without imputation revealed some different results. When data was not imputed only lexicon and attention (See Table 5) seemed to be positively influenced by the attendance of a preschool. However, not significant, the direction of the coefficients for preschool on the memory tasks remained positive (See Table 6). Moreover, in the social-emotional model the conduct behaviour scale was negatively related to preschool (See Table 7). Thus, children who did not attend a preschool exhibited more conduct behaviour. None of the other variables were related to the attendance of a preschool.

Next, the effect of BMI on cognitive and social-emotional development was analyzed. Contrary to the expectations, the digit recall and non-word recall were negatively influenced by BMI (See Table 4). Children with a higher BMI could recall less numbers and non-words in the same order as they heard them. Contrary to the expectations, no positive relation was found between the other aspects of cognitive development and BMI (See Table 3 and 4). The model without imputation showed some alternate results. BMI had no longer influence on the results of the non-word recall (See Table 5). Moreover, the social-emotional development, contrary to expectations, was not influenced by BMI (See Table 7).

Finally, in Model 3 it was tested whether the effect of BMI differed between preschool and non-preschool children. No difference in impact of BMI on cognitive development was found (See Table 3 and 4). The model without imputation showed some different results. A

positive influence of the interaction effect was found on the digit recall. That is, BMI had a positive influence on the recalling of digits only when children attended a preschool. Moreover, no difference in impact of BMI on social-emotional development was found.

Discussion

This study aimed to create a baseline on the cognitive and social-emotional development of preschool children in South Africa by making a comparison between children who attend and not attend preschool in rural township areas in South Africa. We start our discussion with a summary of our findings with regard to the three hypotheses. This study showed that in general preschool children scored higher on cognitive development than children who did not attend preschool. In addition, concerning social-emotional development, preschool children exhibited less conduct behaviour than non-preschool children. No support was found for a positive influence of BMI on cognitive and social-emotional development. Finally, there was little difference between preschool and no preschool children on the effect BMI had on cognitive and social-emotional development.

Overall, the study showed differences in cognitive development and in lesser extends to social-emotional development between children who attend and not attend a preschool. The effect of preschool provides support for the ecological model of Bronfenbrenner (1977), which predicts that children are influenced by their environment. This baseline revealed that an environmental influence such as a preschool positively influences development in children between the age of 2 and 6. Moreover, the results are in line with other studies which found that preschool education positively influences cognitive, language and social-emotional development (Aboud, 2006; Berlinski et al., 2006; Boocock, 1995; Cueto & Diaz, 1999 as cited in Engle et al., 2007; Jamarillo & Tietjen, 2002). Not only do the environmental influences such as preschool proof to be of great importance to western countries, this study underlined the idea that preschool education is beneficial in South Africa. It might be speculated that this does not only hold for South Africa, but also to other third world countries (Aboud, 2006; Berlinski et al., 2006; Boocock, 1995; Cueto & Diaz, 1999 as cited in Engle et al., 2007; Jamarillo & Tietjen, 2002).

In social-emotional development difference was only found on one. The difference in conduct behaviour could be explained by the possible difference in inhibition, because inhibition seemed to be related to conduct behaviour (Berlin & Bohlin, 2002). The higher score for preschool children in inhibition might be clarified by the teaching method. Children

in preschools might have to sit still and be quiet more often and therefore inhibit their behaviour more frequently. Also other research found differences in social-emotional aspects. Aboud (1997) found differences in play behaviour. Although Aboud (1997) did not find conduct behaviour as a different aspect in behaviour, this study did.

In general BMI did not have a positive influence on cognitive and social-emotional development. In contradiction it was found that children who had a higher BMI scored lower on the non-word recall. Furthermore, the influence of preschool did not differ between the two groups of children. These results were in contradiction with the expectation and results of other studies (Siddiqi, et. al., 2007; Walker, et. al., 2007). The contradicting results might be due to the higher BMI in the non-preschool children. The hypotheses were proposed on the expectation that children in the preschool were better nourished. This is not the case. The negative effect of BMI on the non-word recall might be explained by the lack of education of these children. Possibly, education reduces the effect of malnourishment, because of extra stimulation in the preschools.

In consideration of Bronfenbrenner's ecological model we expect that, besides BMI and preschool, more environmental aspects play an important role in the development of young children in rural areas in South Africa. These influences can come from the different levels, for example, parental childrearing practices, safe playing environment, parental involvement in education, quality of the preschool and the teachers, province policy and even governmental policy (e.g., subsidies).

Limitations and implications

The presented study has some limitations which need to be considered in the interpretation of the results. First, preschool children were better testable than non-preschool children, which is difficult for comparative reasons. However, to avoid bias as much as possible the data was analysed two times, one with imputation and one without imputation. The true difference between preschool children and non-preschool children could be found somewhere in the middle of these results, because data with imputation overestimates the effect of preschool and data without imputation underestimates the effect of preschool. Further research is necessary to conclude to which extend cognitive development is influenced by the attendance of a preschool. Research should also focus on the reason why these children are not testable, so alternative ways of testing can be established. Furthermore, the testability of the children gives an indication of school readiness. The preschool children

were better able to sit down and do the tests. The skills that are necessary for doing the tests are skills which are important in primary school (i.e., sitting down, following direction, listening to an explanation, concentrate on a task). Since non-preschool children are clearly less ready than preschool children, they start with a disadvantage at this might remain during primary school.

Second, material could be improved. The tests used in this study have not been validated for the focused group by other studies. However, the results of the tests provide a good indication of the cognitive development, because the tests cover basic cognitive aspects and skills which are important for school readiness and develop in the preschool period. Furthermore, bias in the tests were reduced by making them process based, paper pencil and in their native language. Additionally results were only compared with children in the research area and not with the international norms. In future research the instruments should be validated for this group, for example, by using a test-retest model or comparison between different areas in South Africa. Moreover, the unexpected results in social-emotional development might be due to the testing material. The social-emotional questionnaires seemed unsuitable for testing the social-emotional development of young children in this area. A problem with questionnaires was experienced in Dennilton before (Brands, et al., 2009; Van der Lubbe, et al., 2008; Van Dijk, et al., 2008). Brands (et al., 2009) states that in this area questionnaires can easily lead to social desirable answers and channelling of answers. Therefore questionnaires are less usable here than in other areas. Additionally, in group discussions with the parents, the answers on subjects of social-emotional behaviour were also inconsistent. The focus of the parents was usually on a little detail of the question. Asking questions is probably not the desirable way to investigate social-emotional behaviour in these settings. In future research a different manner to analyse social-emotional behaviour should be used or added. To avoid social desirability and inconsistent data, observations or teacher reports might be more useful. However, despite some test difficulties, this is a baseline study that many future studies can be compared with and made extensions of.

Third, we expect that development of the children was not only influenced by preschool and BMI, also other environmental factors could also play a role. Future research should focus on other environmental factors. Engle (2007) states that quality is important for the effectivity of early intervention. Therefore, investigation about the quality of the preschools in rural township areas in South Africa is important. These result should indicate whether quality improvement can contribute to reaching the development potential of these

children. Van der Laan (2010) assessed found differences in the quality of preschools. In the future, it should be investigated whether these differences lead to alternate development.

To conclude, this research has important implications for the future of preschool education in rural township areas in South Africa. The study stresses the importance of attending a preschool. Effort should be made to make preschool education available for all the children. In addition, the importance of preschool education should be emphasized more strongly to parents, so more children, also the children who are well fed, will attend preschool. These efforts can reduce retention in primary school, increase school success, provide an opportunity for a more productive life and diminish the intergenerational poverty.

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