

ECD Working Paper Series

No. ECD WP006/2023

The cognitive gains case for ECD: Missing pieces of the puzzle

Servaas van der Berg

June 2023

The cognitive gains case for ECD: Missing pieces of the puzzle

Servaas van der Berg

Abstract

The 'Heckman equation' is universally used as a heuristic device to make a generic case for early investment in children. Against the background of the Heckman curve, this paper investigates whether there is such evidence to support this case regarding the cognitive gains from early childhood development (ECD) in South Africa. In doing so, I acknowledge the recent extension of the frontiers of our knowledge on ECD, such as the Early Learning Measurement (ELOM) tool benchmarks and surveys, the Thrive by Five Index data, the ECD Census and ECD audit, reports by Ilifa Labantwana and others, and the World Bank's Public Expenditure and Institutional Review.

I use this data and literature to ask a few questions that may be pertinent for the cognitive case for ECD. In earlier work using the Early Learning Programme Outcomes (ELPO) study, I found considerable cognitive gains associated with ECD attendance in five relatively poor but well-performing ECD centres for children in grade 00 (the year before entering grade R). In contrast, a representative survey of Western Cape ECD centres by Biersteker et al (2016) of the classroom environment found 'very inadequate quality stimulation'. Utilising Thrive by Five data, I attempt to determine whether earlier ECD attendance shows an association with better cognitive performance at the end of grade 00. I find evidence of such cognitive gains only in relatively more affluent (quintile 5) centres. Data limitations prevent more precise answers, but the evidence may suggest limited cognitive gains from attending ECD for children from poorer backgrounds. Thus is similar to our earlier findings that cognitive gains from the roll-out of grade R centres were mainly restricted to relatively more affluent settings. While ECD attendance also brings other benefits, such as safety, child-care for working mothers and nutrition, this preliminary evidence should be taken as strengthening the need for ensuring ECD quality with regard to cognitive stimulation and development.

View other papers in this series here: <https://ilifalabantwana.co.za/ilifa-resep-eecd-working-paper-series/>

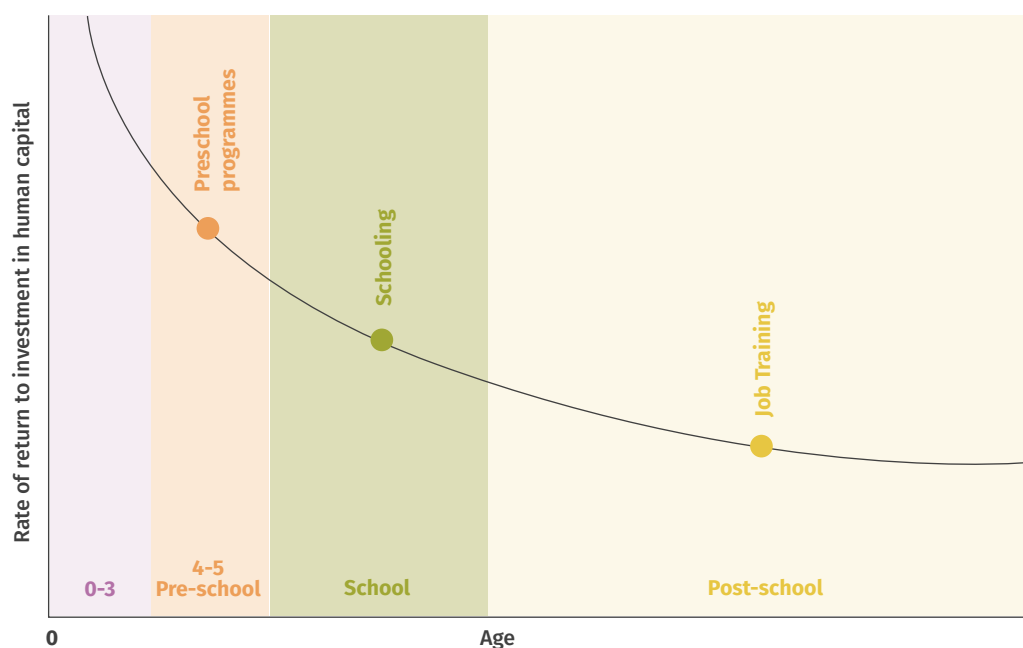


1. Introduction

The case for early childhood development (ECD) is often made using the Heckman curve as the point of departure. James Heckman, Nobel Prize winner in Economics in 2000 for his development of theory and econometric methods to analyse individual or household behaviour, is better known outside economics for his work on the importance of early investment in children. The Heckman curve or Heckman equation is universally used as a heuristic device to make a generic case for early investment in children. It is used to demonstrate that “...the highest rate of economic returns comes from the earliest investments in children ... society invests too much money in later development, when it’s often too late to provide great value.” (Heckman: The Economics of Human Potential, n.d.)

This is reflected in Figure 1 below, which shows that the returns on investment in individuals decline with age.

Figure 1: Rate of return to a dollar of investment in human capital



Source: Heckman, 2008: 311, Figure 18a

The perspective that early investment in children may obviate the need for some later investments, which typically will cost more to yield similar results, is widely accepted. An alternative view is that the extended period over which interventions could bear fruit leads to higher returns on early investments. If children struggle to learn early in their school career, it is much more challenging to deal with when they are approaching grade 12 than it would have been while they were young. So this curve shows declining returns to investment.

A report on learning in East Asia and the Pacific sets out the case for ECD well, based on evidence provided by Heckman and a host of other researchers:

Early childhood education perhaps has the strongest evidence demonstrating its positive contribution to foundational literacy and numeracy and general primary school learning outcomes. Research from around the world shows that early childhood education at home or in quality centre-based environments have a pivotal role in children’s holistic development. It gives children a greater chance to succeed in primary school and throughout the critical early childhood period. Providing young children with access to nurturing, stimulating and secure environments lays the foundation for their healthy cognitive, language, socioemotional and physical development. The research also shows that quality early childhood education programmes benefit disadvantaged children’s learning the most. (UNICEF, 2022:41)

Against the Heckman curve background, this paper investigates what evidence can be brought to bear to make a case for and to improve policymaking regarding ECD in South Africa. The focus will be on cognitive outcomes related to early learning programme access. This should not imply that other benefits from ECD, such as nutrition, socio-emotional development and providing a safe environment, are unimportant. In evaluating the evidence, it is important to acknowledge the pathbreaking role of those who were instrumental in extending the frontiers of our knowledge on ECD in South Africa. The Early Learning Measure (ELOM) benchmarking work, the Thrive by Five Index, the ECD Census and the ECD Baseline Audit are particularly relevant. However, the field has also been further enriched by many reports, inter alia by Ilifa Labantwana and the Children's Institute at the University of Cape Town, and a draft **Public Expenditure and Institutional Review** undertaken by the World Bank. This allowed new investigations assessing the case for ECD. Still, it also brought to the fore that there are many things that we do not yet know and that some things that are taken for granted might not be as well-established as people usually think.

In this paper, I use some of this data and draw from a small part of this expanding literature to ask a few questions that may be pertinent in making a case for ECD and enhancing our understanding to improve ECD policy.

2. The quality of ECD

Poor school quality has been shown to constrain cognitive outcomes for the poorer segments of the South African population. There is also much evidence that the *physical* infrastructure in many ECD facilities needs to be improved. Such facilities are essential for health and safety but are also required to qualify for government subsidies. Subsidies lower the cost to parents of enrolling their children and may allow the subsidised ECD programmes to improve the staffing numbers, food provision, availability of learning and teaching support materials (LTSM) or allow for more attention to improved management.¹ However, even if physical facilities were adequate, the quality of ECD regarding young children's cognitive and socio-emotional development remains an additional concern. ECD should offer high-quality care that "...provides children with a wide variety of age-appropriate activities to support development across domains: a focus on language; a balance of free choice and teacher-directed activities; and warm teacher-child interaction that promotes learning." (Biersteker et al., 2016: 335).

Much has been written about the physical inadequacy of many ECD facilities. Some case studies highlight that children must be sufficiently stimulated in such facilities (Brooks et al., 2022; Excell, 2016; Hall et al., 2017, 2019). However, there needs to be a more formal and systematic measurement of quality aspects of child development. A major exception is a study by Biersteker et al. (2016), who studied ECD quality along various dimensions in a relatively large (242 centres) and representative sample of ECD centres in the Western Cape. To measure the quality of the classroom environment, they used two international scales, the Infant and Toddler Environmental Rating Scale-Revised (ITERS-R) and the Early Childhood Environmental Rating Scale-Revised (ECERS-R). Although these are not measures of cognitive outcomes, the sub-scales offer insight into the quality of care, including some critical dimensions for learning. For instance, for toddlers and infants (the younger of the two groups they distinguish), they state that the "activities subscale goes to the heart of the learning program and measures exposure to a range of activities that are important in scaffolding development. Findings indicate very inadequate quality stimulation of infants and toddlers." (Biersteker et al., 2016: 339)

Also worrying for the older group (in what they refer to as early childhood classes), "... provision for stimulation (Activities) and language (Language and Reasoning) was within the minimal range... Given the particular

¹This is dealt with in some detail in the soon to be released World Bank report on South African ECD.

importance of these areas in enabling readiness to learn in school, the result is of considerable concern.” (Biersteker et al., 2016: 340)

Amongst toddlers and infants, only 34% of centres scored ‘good’ on activities, and a somewhat better but still disappointing 45% amongst older children (3 years or more). Even lower scores were achieved for Language and Talking amongst the younger group (only 8% scored ‘good’), and 18% amongst the older group scored ‘good’ for Language and Reasoning. Considering that the Western Cape has fewer impoverished areas and the province is one where oversight is considered to be better than average, these weak results are disconcerting. Discouragingly, in linear regressions, the researchers found only two factors to be systematically correlated with the quality of care as they measured it, namely weekly fees and centre management quality.

Before the Thrive by Five Index (discussed in the next section), the most comprehensive testing using the newly developed ELOM benchmark was undertaken in 2019 by the ELOM team of a broadly nationally representative Grade R sample. For children aged 60 to 69 months, only 54% of the Quintile 1 sample, 56% of the Quintiles 2 & 3 sample, and 75% of the Quintiles 4 & 5 sample² were assessed as being ‘on track’ (Innovation Edge 2019: 12) for entering Grade R, even though testing took place in the second term of Grade R. The younger age group, 50 to 59 months, performed even more weakly when measured against the ELOM benchmarks for their age group.

In the 2018 ELPO study of performance in five ECD programmes (both centres and playgroups), only 28% of participants in this younger age group were found to be ‘on track’ in the baseline test at the beginning of the year preceding Grade R (Van der Berg 2021: 13, Figure 4). However, this applied only to this convenience sample, which was not nationally representative.

Considering all of this, there can be no doubt of the dire need for expanding children’s cognitive development before entering Grade R.

3. Cognitive gains from ECD

3.1. Contextual evidence

South African children have generally performed poorly in international testing programmes or ILSAs (international large-scale assessments), even compared to other countries in Southern Africa. For instance, South African children performed close to the average for all the participating countries in the SACMEQ³ Grade 6 tests in Reading and Mathematics, despite South Africa being one of the richest of the fifteen participating countries. Even two much poorer countries, Kenya and Eswatini (Swaziland), outperformed South Africa in both Reading and Mathematics (Karogo et al., 2017). In 2016, South African grade 4 students performed poorly in another international large-scale assessment, PIRLS⁴: only 22% could reach the low international benchmark for reading, compared to an average of 96% for the 50 participating countries (though few lower- or middle-income countries participated). Failure to reach this benchmark indicates that children have not mastered basic reading in their home language. (Howie et al., 2017).⁵

²The published results (Innovation Edge, 2019) combined the samples for Quintiles 2 and 3 and also for Quintiles 4 and 5. This decision was taken based on overlaps between the confidence intervals.

³SACMEQ is the Southern and Eastern African Consortium for Monitoring Educational Quality, a cooperative international assessment of Reading and Mathematics in Grade 6 in 15 countries of the region.

⁴PIRLS stands for the Progress in International Reading Literacy Study, an international assessment and research project designed to measure reading achievement that covers around 50 countries.

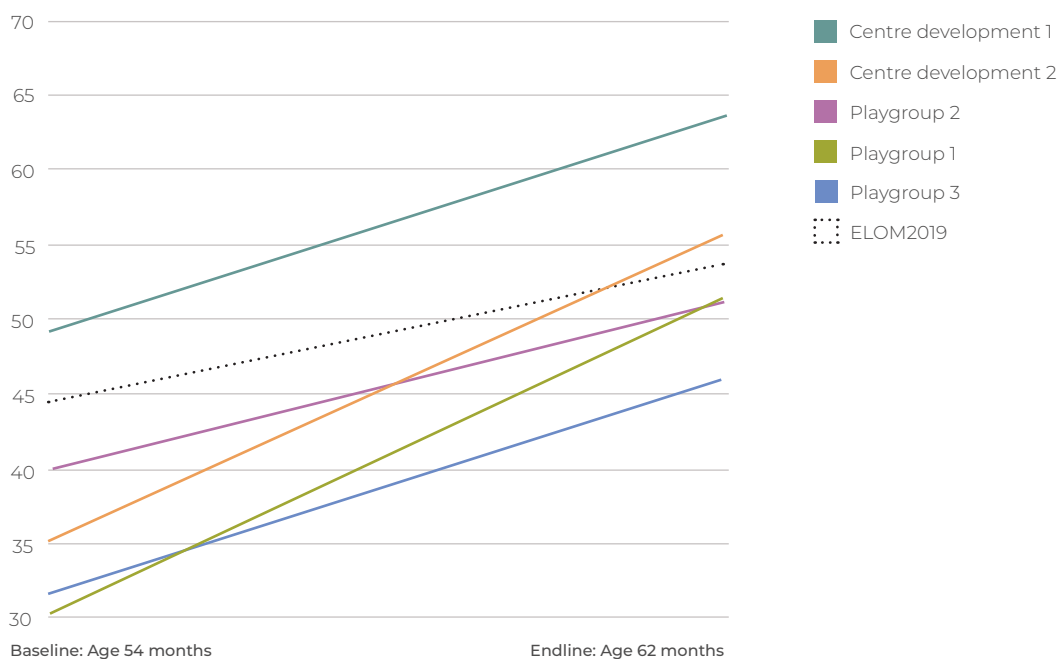
⁵In most schools, the test was written in the language in which children were taught in the Foundation Phase (Grades R to 3), which for most children also was their home language.

Against this background, efforts must be directed at building the educational foundations for school success in the lower grades, even before children enter school. An earlier study (Van der Berg et al., 2013) found negligible gains from participation in Grade R outside the top two school quintiles. The recent development of the ELOM benchmarks for testing children between the ages of 50 and 69 months was a giant step forward for undertaking testing in ECD programmes (Dawes et al., 2020a, 2020b, 2022c). After the benchmarks were developed and carefully tested to be appropriate for the South African context and in all official languages, a broadly representative survey was conducted to test the performance of South African Grade R learners against this benchmark.

In a study for Ilifa Labantwana (Van der Berg, 2021), I compared gains in cognitive outcomes from five ECD programmes targeted at poorer children (ELPO) to normal gains from maturation of 1.0 to 1.2 standard deviations per month in ELOM benchmark studies, using the overall ELOM scores. The children tested were effectively in what is sometimes called Grade 00, i.e. the year before entering Grade R.

Figure 2 shows that the gains in ELOM scores per month for those attending these five programmes, as reflected in the slope for the different programmes, were in all cases above those from simply growing older (the dotted line). These above-average programmes showed substantial gains. However, Dawes (2020a: 9) pointed out that these ECD playgroups and centres had been “rated as well-functioning by their parent organisations. The same programmes, if poorly delivered, could not be expected to show the same outcomes...”

Figure 2: Cognitive gains from 5 ECD programmes compared to normal gains from maturation



Source: (Van der Berg, 2021)

3.2. Investigating cognitive gains from ECD from Thrive by Five data

The 2021 Thrive by Five study tested a large, nationally representative sample of more than 5,500 children aged 4-5 years attending ECD centres on the ELOM benchmarks as a parallel study to the ECD Baseline Audit (DataDrive & Department of Basic Education, 2021; Giese et al., 2022). These children were thus all in what we referred to as Grade 00, i.e. the year preceding Grade R. One variable captured⁶ was the date of the first enrolment in an ECD programme. This made it possible to investigate whether more prolonged exposure before the year of the survey is associated with better performance on the ELOM benchmark tests. This implies that it is possible to test for the possible influence of ECD attendance **before Grade 00** on cognitive outcomes at the end of the Grade 00 year.

⁶But only for about 70% of participating children; the date of first enrolment seemed not to have been captured in the first month of the survey.

However, a difficulty in this regard is that exposure to ECD in the years before entering Grade 00 (i.e. the period since enrolment in ECD until entering Grade 00) may not be as good a proxy of 'treatment' for this year in which there were long periods during which centres may have been closed, or children may not have been attending because of the COVID-19 pandemic (Wills & Kika-Mistry, 2020).

The regression results for both models shown in Table 1 also control for the age of the child, gender, and the school quintile that the ECD centre seemed to be associated with. The quintile variable may be problematic, an issue I return to later. In the second regression, the length of the previous enrolment (i.e. before the survey year, 2021) is also interacted with the quintile.

Figure 3: Average marginal effects with a 95% confidence level

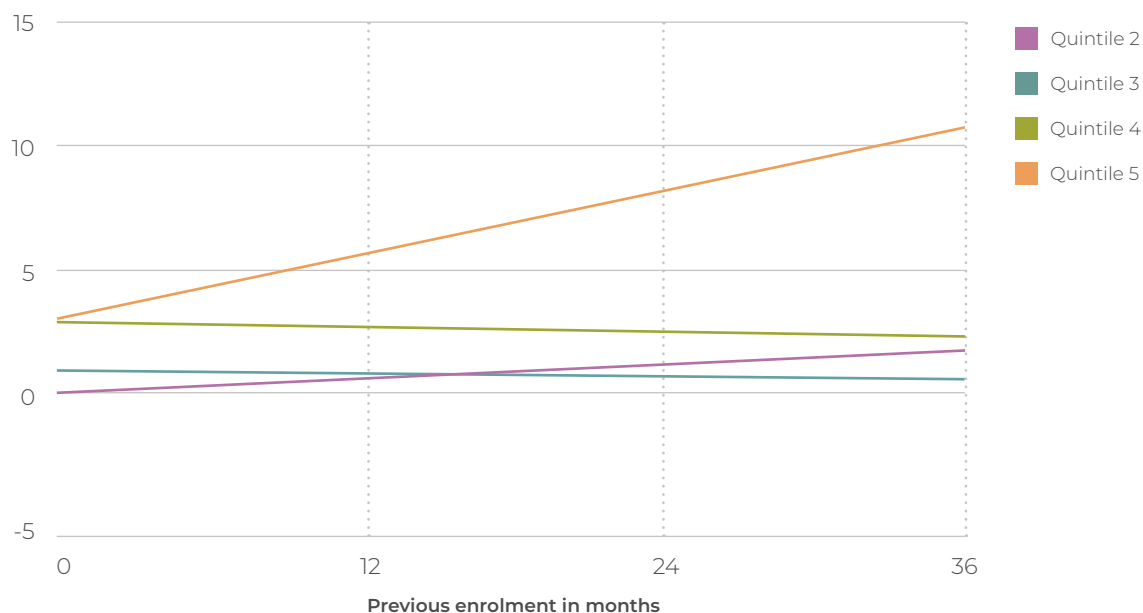


Table 1: Regressions of ELOM outcomes in the Thrive by Five sample

	Model 1 (Simple model)	Model 2 (Interaction model)
Female	3.025***	3.007***
Age (months)	1.202***	1.203***
Quintile (Ref. category: Quintile 1)		
Quintile 2	0.527	0.009
Quintile 3	0.828	0.979
Quintile 4	2.739**	2.912***
Quintile 5	5.466***	3.004***
Previous enrolment (months)	0.040**	0.010
Quintile2*Previous enrolment	-	0.047
Quintile3*Previous enrolment	-	-0.011
Quintile4*Previous enrolment	-	-0.017
Quintile5*Previous enrolment	-	0.216***
Constant	-24.304	-23.916***
R-squared	0.0853	0.091
N	3812	3812

*** p<.01, ** p<.05, * p<.10

Source: Regression based on Thrive by Five data obtained from DataFirst, 30 December 2022. Previous enrolment was calculated as the length of enrolment in ECD minus ten months (the average length of enrolment in 2021 at the time of the survey).

The dotted line in Figure 2 shows that children at the end of Grade 00 are typically 62 months old and score about 54 points on the ELOM scale. It is also notable that the age of the child is highly significant; the coefficient of 1.20 in both models implies that ELOM scores tend to be just over 1 ELOM point higher for every month that the child is older, similar to the coefficients reported in earlier regressions on ELOM data (Van der Berg, 2021). As is usual in such studies in South Africa, girls perform much better, on average about 3 ELOM points in both models. Not unexpectedly, higher quintiles perform better, with Quintile 4 and Quintile 5 performing significantly better than the reference group, Quintile 1.⁷

However, the general association between earlier enrolment in ECD and ELOM scores is weak, even though it is statistically significant in the simple model. Its value of 0.040 implies that a full year's earlier enrolment in ECD pre-Grade 00 would bring a gain of less than 0.5 ELOM points once all the other variables in the simple model have been considered. On its own, it thus appears as if earlier exposure to ECD does not bring much performance advantage.

Regression Model 2 in the table allows enrolment effects to differ across quintiles. Here the general association between earlier enrolment and ELOM scores is even smaller and no longer statistically significant. The marginal effects for the bottom four quintiles are statistically indistinguishable from zero (see also the marginsplot in Figure 3). The exception, though, is Quintile 5, which, when interacted with the length of enrolment, has a statistically highly significant association with ELOM scores. More prolonged ECD exposure is associated with improved cognitive performance only in ECD centres in proximity to Quintile 5 (affluent) schools. The effects shown in the simple model seem to be driven wholly by the gains in ELOM scores found in Quintile 5 programmes. However, though statistically significant, the coefficient on the Quintile 5 interaction with the previous enrolment is still not particularly large at 0.216 for a month's enrolment, which, converted to a full year of ECD, means a gain of about 2½ ELOM points. To put this in perspective, this is not more than the gender advantage that girls hold and only about one-quarter of the typical maturation gains over a year.

Model 2 results are remarkably like those found for the impact of Grade R on learning outcomes referred to earlier, where gains from attending Grade R were confined to Quintile 4 and 5 schools. Re-running Model 1 while excluding Quintile 5 centres (results not shown) reduces the coefficient on the previous enrolment even further and renders it statistically insignificant. This supports the perspective that its significance in Model 1 is primarily driven by the positive effects for Quintile 5 centres. Limiting the regression to Quintile 5 centres only (also not shown) gives a much better fit, despite the smaller number of observations. The coefficient on enrolment turns highly statistically significant and is similar in magnitude to that found for Quintile 5 centres in Model 2 at 0.226.

Can the poor quality of ECD explain these results? Heckman has been at pains to stress that high returns from early investment in children apply only to high-quality programmes, as also noted by (Brooks et al., 2022, p. 12) when they state that “the compelling evidence of return on investment in early learning is based on an important caveat: early learning interventions offer a return only if they offer quality”.

The earlier discussion raised severe concerns about the quality of South African ECD programmes. UNICEF's report on learning in East Asia and the Pacific suggests that the tentative regression findings of limited learning gains for poor children in South African ECD centres are also a concern in that world region:

Evidence from East Asia and the Pacific on the impact of improving access and quality to early childhood education is rich, consistent and provides a clear message. In general, increasing the amount of time children spend in early childhood education services increases learning outcomes in primary school – but ONLY when the services are of a minimum quality. This is especially true for children from the most disadvantaged communities. Without quality, early childhood education interventions can lead to null impact or negative impact. In fact, poor-quality early childhood education programme implementation carries big risks of little or negative impact on children, particularly the most disadvantaged. (UNICEF, 2022:90, their emphasis)

⁷The DBE Technical Report on a baseline assessment of ECD (Department of Basic Education, 2022) applied a more comprehensive regression model to a sub-sample of the Thrive by Five data. In that model, too, the top two quintiles were found to perform significantly better than the bottom three quintiles.

Are the regression results credible? Results with such potentially important implications should not be taken at face value. Alternative regression model specifications to allow for other interactions, discontinuities or non-linear effects do not change the results in any major way, except that even the effects found for Quintile 5 centres lose their significance in some specifications.

However, it must be acknowledged that data quality also plays a role, even though this was a large and high-quality survey. The data only applies to children actually in early learning facilities. The fact that no data on previous enrolment were captured for 30% of nested participants reduced the sample size for the regressions, and data were not missing at random: it affected especially younger children and particularly children in Quintiles 2 and 4. However, this is unlikely to influence the results in a major way.

As mentioned earlier, the fact that part of previous enrolment is used as an explanatory variable in these regressions, as a type of proxy for 'treatment' in ECD enrolment, is problematic in a context where the latter part of such 'treatment' before entering Grade 00 would have been during the height of COVID. Centres were closed for long periods, and attendance varied greatly when they were open. (Wills & Kika-Mistry, 2020). This could mean that the 'treatment' in 2020 is over-estimated compared to enrolment before 2020. To test whether that would affect the model, lower weights were given to months enrolled in 2020 than for previous years, in the extreme case, a zero weight. It did not improve the association between previous enrolment and the ELOM scores in the poorer quintiles.

The quintile classification is also problematic. As ECD centres are not attached to schools, in the data collection, ECD centres were classified into quintiles based on the school quintile of the closest schools, using the Department of Basic Education's classification. This information is likely inaccurate in many cases, which would reduce the accuracy of the regressions.⁸

This analysis only relates to children of this age group who were enrolled in early learning programmes at the time of the survey, which occurred at the end of their Grade R year. It thus cannot tell anything about those who did not enrol in ECD before they entered Grade 00. For those enrolled, almost all had been enrolled for the entire Grade 00 year; thus, the length of enrolment says nothing about the influence of such enrolment in Grade 00 or survey year on cognitive outcomes.

This means complete insight into learning *during the Grade 00 year* cannot be gained from available data. There is an urgent need for a survey that is devised like the ELPO study that tested children at baseline (the start of Grade 00) and at endline (the end of Grade 00, just before they enter Grade R). This would allow greater clarity on the effect of enrolment in Grade 00 on cognitive outcomes. A large and representative survey of this nature would not only allow good measurement of learning gains across quintiles but would also make it possible to investigate those factors that may be associated with better learning gains.

3.3. How lasting are any gains likely to be?

Heckman's policy prescriptions depend on the benefits of investing in early childhood development being lasting. The literature is not unanimous that this is the case. Ansari (2018) even contends that more exposure to early learning programmes, while initially academically beneficial, may have detrimental psycho-social effects that could dampen this initial academic advantage in schools. But a study of the Perry Preschool Program in the USA co-authored by Heckman finds that "gains in cognition are sustained through age 54, contradicting claims about cognitive fadeout in the treatment effects of early childhood programs". (García et al., 2021). Heckman also believes that psychosocial benefits might be even more important and lasting than cognitive gains.

⁸Such attenuation of the quintile coefficients due to inaccurate quintile classification are unlikely to affect the coefficient on previous enrolment when it is not interacted with quintile, as in Model 1. Hensry and Giese (2022) use a clustering approach to create an alternative socio-economic classification of centres by combining information on fees and on whether centres receive subsidies. This substantially reduces the number of centres in the highest socio-economic category. However, they have a different version of the data than that publicly available, including a far larger proportion of centres with information on fees.



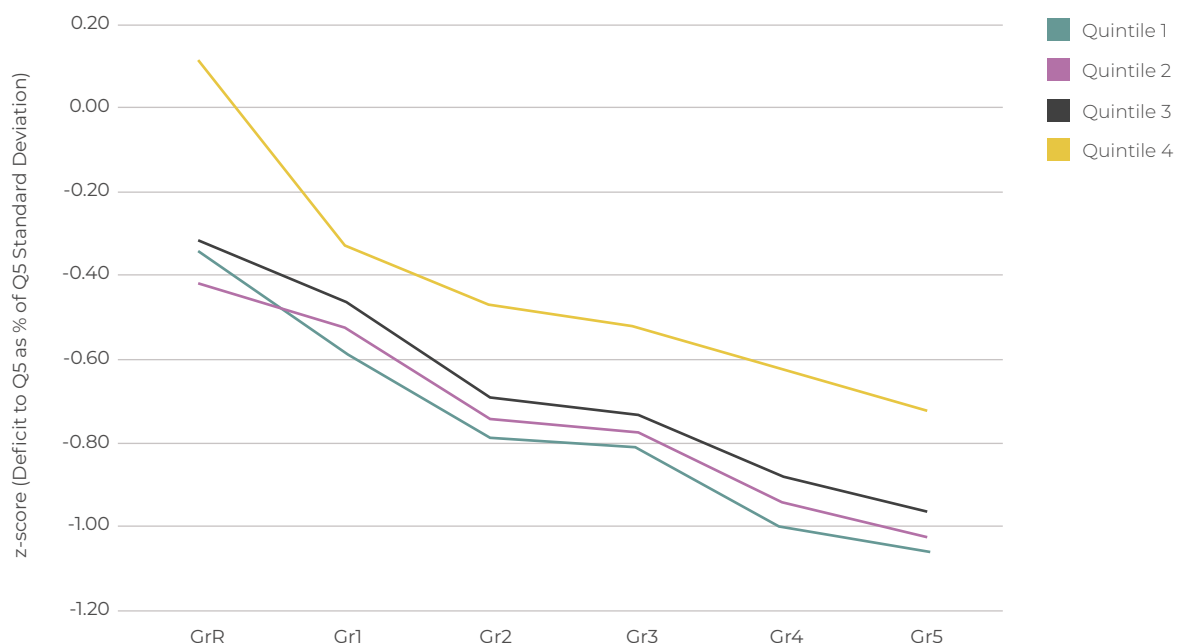
If ECD participation in South Africa were to confer such benefits, would they be lasting?⁹ This question was also raised in one of the reports on the DBE’s Early Grade Reading Study in Northwest province:

It remains an open question whether a home language reading intervention that impacted on reading proficiency in the early grades will yield a persistent benefit to those learners who were impacted. It is conceivable both that the effect may dissipate over time or that it may compound if a solid reading foundation enables more learning later on and in different subject areas. It may be that this will depend on the quality of teaching received in subsequent years. (Taylor et al., 2019)

Arguments for ECD often revolve around the view that poor children’s early deficits prevent them from establishing a solid learning base for performing well at school. No South African dataset allows us to follow a representative group of learners from pre-school to the Foundation Phase and beyond. But our limited data, with all their deficiencies and comparability concerns, provide evidence of widening gaps over the school career.

Analysis of ELOM 2019 Grade R scores and scores in ANA¹⁰ 2013 finds cognitive gaps between other quintiles and Quintile 5 widening at higher grades. Figure 4 shows the average deficit of other quintiles to Quintile 5 Mathematics performance expressed as a percentage of the Quintile 5 standard deviation.¹¹ These imply that the three poorest quintiles perform at Quintile 5 z-scores of around -0.36 in Grade R, declining to -1.02 in Grade 5. These z-scores imply that the average performance of Quintiles 1 to 3 children in the Grade R ELOM 2019 benchmarking study placed them at the 36th percentile of the Quintile 5 performance. In contrast, the ANA 2013 Grade 5 performance of the same quintiles would have placed them at the 15th percentile of the Quintile 5 performance. As can be seen from the figure, Quintile 4 schools had a much smaller, though still substantial, deficit compared to Quintile 5.

Figure 4: Deficit of Quintiles 1 to 4 compared to Quintile 5 performance as a percentage of a standard deviation



Sources: Grade R is the Emergent Numeracy and Mathematics score in the ELOM 2019 Grade R benchmarking; Mathematics scores for other grades are from ANA 2013.

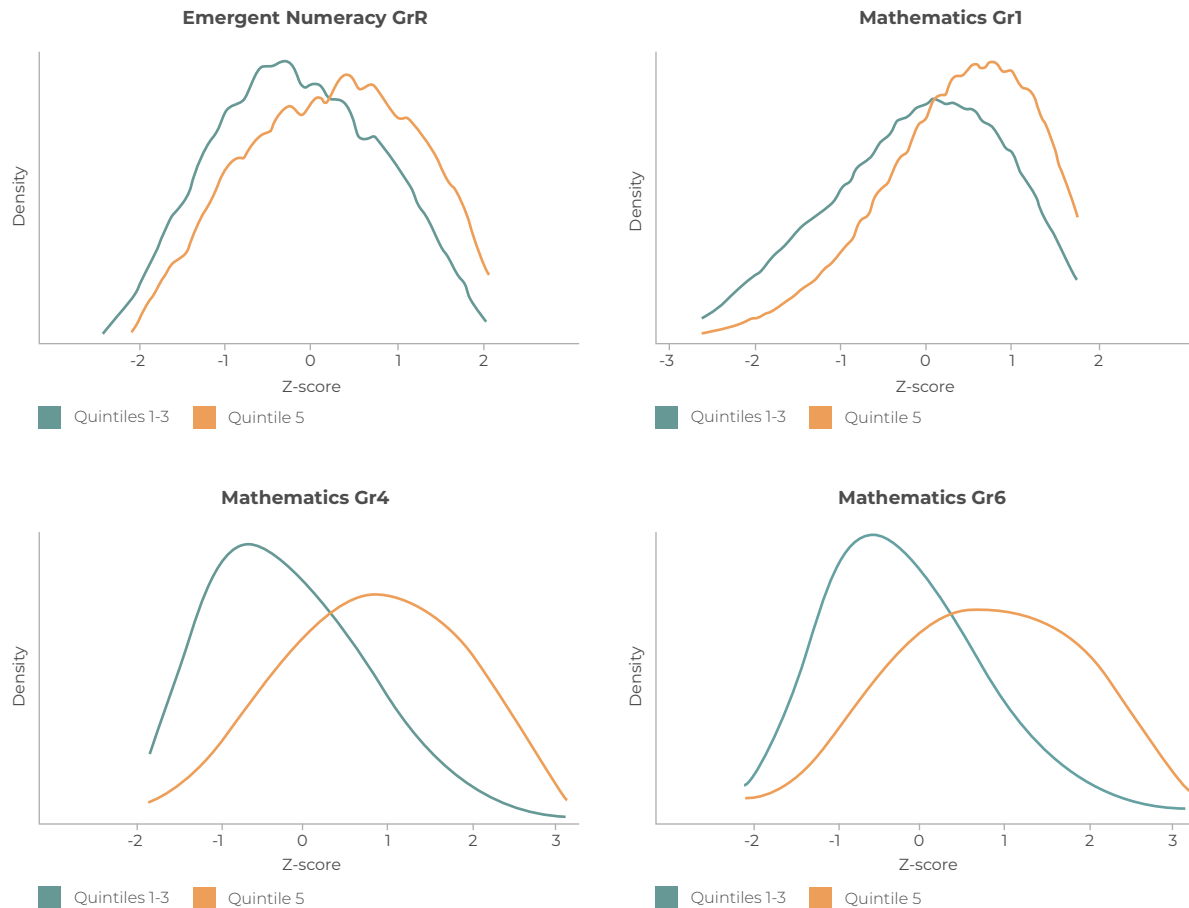
⁹A related question is whether continued ‘treatment’ in the form of an intervention sustained over a longer period experiences diminishing returns in terms of benefits to the children so treated. Cilliers et al. (2022), again drawing from the Early Grade Reading Study, do indeed find such ‘depreciation rates’ in a school context.

¹⁰The ANAs or Annual National Assessments were assessments that were undertaken nationally for a few years (2-12-2015) of all children in Grade 1 to 6 as well as Grade 9, but were discontinued due inter alia to union opposition.

¹¹This is effectively a z-score expressed in terms of Quintile 5 performance, where z is equal to $(\text{Average Quintile } n \text{ ELOM score} - \text{average Quintile 5 ELOM score}) \div \text{Quintile 5 standard deviation}$, with n being the quintile that is compared with Quintile 5. This can be written as $z = \frac{\mu_{Qn} - \mu_{Q5}}{\sigma_{Q5}}$ where μ is the average ELOM score for the quintile referenced in the subscript, and σ the standard deviation. Note that the ELOM-score deficit of other quintiles relative to Quintile 5 is compared to the Quintile 5 standard deviation.

Figure 5 shows the achievement gap between learners from no-fee schools (Quintiles 1-3) and those in Quintile 5, the wealthiest group, converted into z-scores. The top left panel shows a quite small gap in Emergent Numeracy and Mathematics performance between Quintile 5 and the bottom three quintiles. The Grade 1 picture for Mathematics in ANA 2013 looks remarkably similar. In contrast, the gaps in Grades 4 and 6, in the bottom panels, are much wider.

Figure 5: Performance of Quintile 1-3 relative to Quintile 5 learners for Grades R, 1, 4 and 6 (z-scores)



Sources: Emergent Numeracy score from ELOM 2019 benchmarking of Grade R performance; Mathematics scores for Grades 1, 4 and 6 from ANA 2013. All scores were converted to z-scores using the standard deviation for the whole sample to standardise scores. This differs from the z-scores shown in Figure 4, which are calculated relative to the standard deviation in Quintile 5.

Thus the available data, though far from perfect for this purpose,¹² tell a story of narrow initial gaps that widen across the grades. As children progress at school, the proportion performing at a relatively good level consistently declines, whether Mathematics or Language performance is the yardstick. This may imply that the weak performance of poor children in the school system may not necessarily derive from large initial deficits. Are poor schools so inefficient that cognitive gaps widen over the school career, or do home and early learning deficits perhaps interact with school quality to cause widening gaps? Alternatively, it could even be that the full negative impact of missed opportunities for brain and cognitive development only show up so starkly later on.

That cognitive gaps along socio-economic fault lines grow across the school career should not surprise. For many years, we have known that initial gaps in cognitive scores tend to widen in the South African context. See, for instance (Spaull & Kotze, 2015), who provide evidence that those starting behind in school stay behind due to what they see as insurmountable learning deficits.

¹²The ELOM data, used for the data in Grade R, is a broader measure than either cognitive performance in Mathematics or in Language, which are captured by the admittedly old ANA data from 2013.

Widening performance deficits of poor children may not necessarily contradict the Heckman equation. But such pervasive evidence of widening gaps certainly is cause for concern. One possibility is to blame the schools serving the poor, many of which appear unable to convert initial promise into sustained high performance. Or are many poor children's home and social backgrounds insufficiently supportive of sustaining initial gains? Are the many shocks that schools, society and households experience so large that many initial advantages disappear? Strong cross-currents may wash away the early gains if the home, community and school circumstances do not carefully nurture precious early gains. Heckman is particularly concerned about the role of parents rather than schools (Heckman & Mosso, 2014), although this may be influenced by the American situation, where few schools are as dysfunctional as often encountered in South Africa.

Good quality ECD may then be a necessary, though insufficient, condition for poor children to achieve substantial and sustained learning gains. Like the quality of ECD, other institutions – schools and families – also require attention.

4. How to improve quality?

This raises the question of how quality can be improved in those programmes performing poorly in cognitive outcomes. The relationship between income per child and the quality of service is unclear and quite uneven, and some programmes may better convert money or real resources into improved outcomes. We need to learn more about what determines cognitive outcomes in ECD and what the major impediments are to improving such quality. There is a host of international and local experience to draw from (see e.g., DataDrive2030, 2022), but identifying the policy levers to achieve quality ECD in the South African situation still requires much thinking.

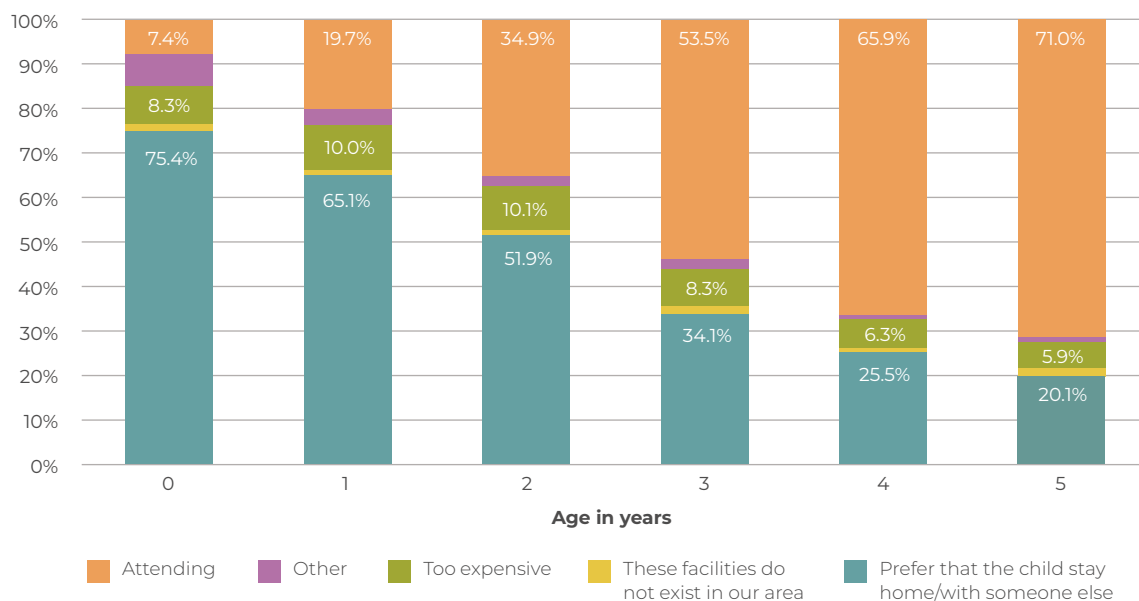
Staff quality is of particular importance. Even by South African standards, ECD staff are generally poorly paid – around 90% of practitioners receive less than the minimum wage (Department of Basic Education, 2021: 21). Working conditions are also not conducive to retaining many for long in the sector, leading to much churning, with staff entering and leaving the sector. The ECD Census found that 37% of ECD staff have been in the ECD sector for five years or less and that 28% were unemployed before finding work in ECD. Thus productivity benefits from experience and sector-specific training may not be retained. Improving the skills of ECD staff requires much further study and experimentation.

5. Raising ECD participation

Constraints to ECD participation exist on the supply side (the non-availability of ECD programmes close to many households, particularly in rural areas) and on the demand side (ECD costs to parents may constitute a barrier to participation). A recent study by Moses (2022) indicates that poor households are more likely to be affected by either of these barriers than their wealthier counterparts. Still, Figure 6 shows a small supply constraint. A planned follow-up study by the same author using the new ECD Census data with General Household Survey (GHS) data may reveal more about the relative magnitude of supply and demand barriers, though these can never be completely separated. In his study, Moses (2022) found a strong relationship between household income and participation in ECD, but also that poor households containing unemployed adult household members are even less inclined to enrol children in ECD, which is supported by the prominence in Figure 6 of responses indicating that parents prefer that the child stays home with

someone else. On the face of it, this may be evidence of an inadequate appreciation of the value of ECD beyond simply, but importantly, offering childcare to parents. However, surprisingly, *participation in ECD increases strongly with age* (Table 2, which uses the more recent GHS2021 data, shows similar age patterns of participation as the GHS2018 data captured in Figure 6). This may indicate some awareness of the value of ECD, at least for older children. However, it is unclear whether the fact that two out of three children enrolled in ECD were not present on the 2021 ECD Census day says something about the perceived value of ECD or whether it was related to new circumstances during the COVID pandemic.

Figure 6: Attendance rates by age and main reason why some do not attend, 2018



Source: Moses, 2022

Table 2: Participation in centre-based ECD (source: GHS2021)

Age	Centre-based ECD	Centre-based ECD or Grade R
0	3%	3%
1	11%	11%
2	23%	23%
3	38%	40%
4	51%	61%
5	30%	72%

Note: Centre-based ECD is defined as pre-school or nursery schools, creches and educare centres.

Source: Calculated from GHS2021

6. How productive are ECD subsidies?

By reducing the cost to parents, ECD subsidies raise participation rates. As parents usually still contribute, it crowds in some household resources by reducing the marginal cost to parents of enrolling children in ECD (Kika-Mistry & Wills, 2022). By making more ECD programmes viable, subsidies encourage the employment of unskilled women in rural areas with few income-earning opportunities. It also has multiplier effects in such poor areas. Thus, such subsidies should be compared to alternative social spending as well as to the cost of employment from public interventions such as the Youth Employment Service.



The meals consumed at early learning programmes may enhance nutritional intake for some children. Regression analysis of the Thrive by Five data shows no statistically significant effect of earlier enrolment on the height-for-age measure of stunting. Given all the other intervening factors, however, that may not be a true reflection of the value of ECD meals. However, a similar analysis using GHS2020 data while controlling for household per capita income revealed a small but significant inverse relationship between participation in centre-based programmes and reported child hunger. This could indicate that participating in early learning programmes brings small nutritional benefits, but it could equally simply point to some endogeneity, in that poor parents who send their children to participate in ECD may also be those more likely to pay greater attention to directing household resources to avoid children being hungry.

Data from the ECD Audit (2021) show that almost 90 per cent of ECD practitioners earned less than the minimum wage of R3 500 per month in 2021. Such data are likely to be only rough approximations, for as Kotze (2015) pointed out concerning the previous ECD audit, “the limitation of the ECD audit lies in the self-reporting of ECD practitioners and therefore the responses on qualification – or on salaries received – might be biased”. Nevertheless, meagre salaries are the norm in most ECD programmes. To some extent, that may be a consequence of low subsidy levels. Higher subsidies may allow higher wages to be paid, making such employment more attractive. This may reduce staff turnover, thus retaining more experienced or trained staff in the sector or attracting better-qualified individuals. On the other hand, higher subsidies may be used to improve other aspects, such as the quality of facilities or materials.

7. Conclusion and some thoughts on how to strengthen the case for ECD in South Africa

7.1. Conclusion: The quality imperative

The regression analysis presented in Section 3 does not find empirical support for the Heckman equation in the South African context regarding *cognitive gains* from investment in early learning programmes as they currently function. The minor positive effects on cognitive scores found for early enrolment in early learning programmes (before the Grade 00 year) do not point to large returns from early learning programmes in the programmes as currently found in South Africa. Even these minimal effects are driven by the positive, though still not very large, effects for centres in wealthier neighbourhoods. However, as the evidence from East Asia and the Pacific indicated, the lack of such effects may not imply that the Heckman curve does not apply but rather that ***both the volume and the quality of the investment in ECD must be enhanced.***

However, this regression analysis should not be taken as the final word. One cannot statistically ***prove the absence*** of effects. Moreover, the Thrive by Five dataset, valuable as it is for this purpose, was designed with a different purpose and cannot provide conclusive results for the purpose used here. As indicated, the regressions can at most say something about exposure to early learning programmes in the years prior to the Thrive by Five Index.

Nevertheless, considering the deficient quality of many programmes, the possible absence of strong learning gains should not be a surprise. The institutions that should be scaffolding children’s learning – the family, ECD programmes and schools – are all weak in our society and jointly contribute to weak learning outcomes for children at all levels. All these institutions need improvement.

7.2. Strengthening the cognitive case for ECD

The available data and information provide inadequate support for the case for early learning programmes as currently constituted to strengthen learning in South Africa. How can this case be strengthened?

Firstly, we need surveys that measure and track cognitive performance across the divide between ECD and the Foundation Phase in schools. These surveys would have to be large, because the effect sizes of interventions may be small and difficult to establish with smaller data sets and also because such studies would typically experience much attrition, as it is difficult to track children from ECD programmes into schools.

There has been some work on the situation of ECD staff (e.g. Harrison, 2020). However, we still know too little about the retention, training and training needs of ECD staff, how to improve retention of trained and experienced staff and how government subsidies could perhaps also play a part.

Next, we need to look at the cognitive gains of ECD programmes on a bigger scale. The ELPO study was immensely valuable for showing that some well-functioning programmes (including even some playgroups rather than centre-based programmes) can be very productive and offer significant gains and cognitive returns amongst poor children.¹³ Yet we need to know what is happening across many programmes and why some are successful and others are not. As argued earlier, an ELPO-like study across a large number of ECD programmes, with baseline and endline measurement of cognitive performance, is urgently needed to measure cognitive gains from exposure to ECD, particularly in the year before children enter Grade R. Such a survey should ideally be combined with measurement of the quality of services and child-practitioner interactions at programme sites, as illustrated in the study by Biersteker et al. (2016). Then we must find ways to utilise such information for policy purposes, such as developing training programmes, supporting the design of quality assurance processes or increasing the value and reach of the subsidy.

Finally (and this is the strongest conclusion from this study), we need a strong focus on ECD quality regarding cognitive performance to balance the need to increase the availability of affordable ECD centres and the quality of learning. Expanding participation must occur parallel to efforts to enhance quality, especially quality of learning, while keeping sight of other important outcomes such as nutrition and safety. For this to happen, we need a greater understanding of the essential criteria for ECD programmes to function well as centres of learning. This would make the implicit promise of the Heckman curve a reality.

¹³This topic requires more attention in the debate about expanding early learning programmes. Brooks et al. (2022) contrast a centre-based with a mixed model approach to expanding ECD access.

References

- Ansari, A. (2018). The persistence of preschool effects from early childhood through adolescence. *Journal of Educational Psychology*, 110(7), 952–973.
- Biersteker, L., Dawes, A., Hendricks, L., & Tredoux, C. (2016). Center-based early childhood care and education program quality: A South African study. *Early Childhood Research Quarterly*, 36, 334–344. <https://doi.org/10.1016/j.ecresq.2016.01.004>
- Brooks, L. E., Kotzé, J., Almeleh, C., & Senona, E. (2022). Assessing the policy options for the public provisioning of early childhood development programmes. *South African Journal on Human Rights*, 1–21. <https://doi.org/10.1080/02587203.2022.2149614>
- Brooks, L., Mohamed, Z., Almeleh, C., & Maharaj, S. (2022). Towards universal access: A three-year acceleration plan for ECD funding (Early Childhood Development Accelerator Series). Ilifa Labantwana.
- Cilliers, J., Fleisch, B., Kotze, J., Mohohlwane, M., & Taylor, S. (2022). The Challenge of Sustaining Effective Teaching: Spillovers, Fade-out, and the Cost-effectiveness of Teacher Development Programs. *Economics of Education Review*, 87, 102215. <https://doi.org/10.1016/j.econedurev.2021.102215>
- DataDrive 2030, & Department of Basic Education. (2021). Thrive by Five Index and ECD Baseline Audit 2021, Version 1r [Data set]. DataFirst. <https://doi.org/10.25828/DOZX-6K11>
- DataDrive2030. (2022). Improving the quality of teaching and learning in South African early learning programmes, at scale. DataDrive2030. https://datadrive2030.co.za/wp-content/uploads/2022/11/Datadrive2030_Policy-Brief_24_Nov_final2.pdf
- Dawes, A., Biersteker, L., Girdwood, E., Snelling, M., & Horler, J. (2020a). Early Learning Programme Outcomes Study Technical Report. Innovation Edge & Ilifa Labantwana.
- Dawes, A., Biersteker, L., Girdwood, E., Snelling, M., & Horler, J. (2020b). The Early Learning Outcomes Study: Research Insights. Innovation Edge & Ilifa Labantwana.
- Dawes, A., Biersteker, L., Girdwood, E., & Snelling, M. (2020c). Early Learning Outcomes Measure: Technical Manual 3rd edition (update of 2016 edition). Innovation Edge & Ilifa Labantwana.
- Department of Basic Education. (2022). Baseline Assessment—Technical report [Technical report]. <https://datadrive2030.co.za/wp-content/uploads/2022/10/Baseline-Assessment-Report.-2022.pdf>
- Excell, L. (2016). Interrogating quality in early childhood development: Working towards a South African perspective. *South African Journal of Childhood Education*, 6(1), 9. <https://doi.org/10.4102/sajce.v6i1.406>
- García, J. L., Heckman, J., & Ronda, V. (2021). The Lasting Effects of Early Childhood Education on Promoting the Skills and Social Mobility of Disadvantaged African Americans (No. w29057; p. w29057). National Bureau of Economic Research. <https://doi.org/10.3386/w29057>
- Giese, S., Dawes, A., Tredoux, C., Mattes, F., Bridgman, G., Van der Berg, S., Schenk, J., & Kotzé, J. (2022). Thrive by Five Index Report (Revised August 2022). Innovation Edge. <https://www.thrivebyfive.co.za/wp-content/uploads/2022/09/Thrive-by-Five-Index-report-Revised-August-2022-FINAL.pdf>
- Hall, K., Sambu, W., Almelleh, C., Mabaso, K., Giese, S., & Proudfoot, P. (2019). South African Early Childhood Review 2019. Children's Institute, University of Cape Town & Ilifa Labantwana. http://childrencount.uct.ac.za/uploads/publications/SA%20ECR_2019.pdf
- Hall, K., Sambu, W., Berry, L., Giese, S., & Almelleh, C. (2017). South African Early Childhood Review 2017. Children's Institute, University of Cape Town & Ilifa Labantwana.
- Harrison, G. D. (2020). A snapshot of early childhood care and education in South Africa: Institutional offerings, challenges and recommendations. *South African Journal of Childhood Education*, 10(1). <https://doi.org/10.4102/sajce.v10i1.797>
- Heckman: The economics of human potential. (n.d.). The Heckman Equation. <https://heckmanequation.org/>
- Henry, J., & Giese, S. (2022). Reviewing the socio-economic gradient in learning outcomes for children who participated in the thrive by five index (DataDrive2030 Insights) [Policy/Learning Brief]. https://datadrive2030.co.za/wp-content/uploads/2022/09/SES_Problem_statement-for-website.docx-2-1.pdf
- Howie, S.J., Combrinck, C., Roux, K., Tshele, M., Mokoena, G.M., & McLeod Palane, N. (2017). PIRLS literacy 2016: South African Highlights Report. Centre for Evaluation and Assessment.
- Innovation Edge. (2019). The South African Early Years Index. Innovation Edge.
- Karogo, Mercy G., Matei, Asumpta, Kipchirchi, Musa, Kawira, Doreen, & Omunyang'oli, Patricia. (2017). The SACMEQ IV project in Kenya: A study of the conditions of schooling and the quality of education. Kenya National Examinations Council. <http://www.sacmeq.org/?q=sacmeq-members/kenya/sacmeq-reports>
- Kika-Mistry, J., & Wills, G. (2022). Compliance, cost and user fees in the early childhood care and education sector in South Africa. Ilifa



Labantwana-Resep Working Paper ECD WP 005/2022.

Kotze, J. (2015). Can pre-grade R be the stepping stone to social equality in South Africa. *South African Journal of Childhood Education*, 5(2), 27. <https://doi.org/10.4102/sajce.v5i2.388>

Moses, E. (2022). Enrolment in Early Childhood Development centres in South Africa: Challenges and opportunities. Ilifa Labantwana-Resep Working Paper ECD WP 002/2021.

Spaull, N., & Kotze, J. (2015). Starting behind and staying behind in South Africa. *International Journal of Educational Development*, 41, 13–24. <https://doi.org/10.1016/j.ijedudev.2015.01.002>

Taylor, S, Cilliers, J, Prinsloo, C, Fleisch, B, & Reddy, V. (2019). Improving early grade reading in South Africa. International Initiative for Impact Evaluation (3ie). <https://www.3ieimpact.org/sites/default/files/2019-03/GFR-pw2.10-Early-grade-reading-southafrica.pdf>

Van der Berg, S. (2021). Estimating the impact of five early childhood development programmes against a counterfactual (Ilifa-Resep ECD Working Paper Series). Ilifa Labantwana & Resep. <https://www.ssrn.com/abstract=4009549>

Van der Berg, Servaas, Girdwood, Elizebeth, Shepherd, Debra, Van Wyk, Chris, Kruger, John, Janeli Viljoen, Ezeobi, Olivia, & Ntaka., Poppie. (2013). The impact of the introduction of Grade R on learning outcomes [Final Report for the Department of Basic Education and the Department of Performance Monitoring and Evaluation in the Presidency]. Resep (Research on Socio-economic Policy). <https://resep.sun.ac.za/wp-content/uploads/2014/06/Grade-R-Evaluation-1-3-25-Final-Unpublished-Report-13-06-17.pdf>

Wills, G., Kotzé, J., & Kika-Mistry, J. (2020). A Sector Hanging in the Balance: Early Childhood Development and Lockdown in South Africa. Research on Improving Systems of Education (RISE). https://doi.org/10.35489/BSG-RISE-WP_2020/055

ILIFA-RESEP ECD WORKING PAPER SERIES:

Estimating the impact of five early childhood development programmes against a counterfactual:

[VIEW HERE](#)

Enrolment in early childhood care and education programmes in South Africa- challenges and opportunities:

[VIEW HERE](#)

Supply-side and demand-side approaches to financing early childhood care and education in South Africa:

[VIEW HERE](#)

Priority areas for reducing stunting in South Africa: Examining the implications of recent international evidence:

[VIEW HERE](#)

Compliance, cost and user fees in the Early Childhood Care and Education Sector in South Africa:

[VIEW HERE](#)