thrive^5
thrive by five | INDEX

Thrive by five Index Technical Report

July 2022

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

INNOVATION EDGE

USAID
FROM THE AMERICAN PEOPLE

ECD measure

Sponsored by

Thrive by Five Index 2021
Technical Report, Revised* July 2022

Colin Tredoux, Andrew Dawes and Frances Mattes

(Psychology Department, University of Cape Town)

March 2022, revised July 2022

* This report replaces the previous technical report (April 2022) in its entirety. The most significant changes are to stunting data, which were incorrectly computed in the previous report.

Table of Contents

ACRONYMS

CEF	Cognition and Executive Functioning
CI	confidence interval
DBE	Department of Basic Education
DSD	Department of Social Development
ECD	early childhood development
ELL	Emergent Literacy and Language
ELOM	Early Learning Outcomes Measure
ELP	Early Learning Programme
ENM	Emergent Numeracy and Mathematics
FMC-VMI	Fine Motor Coordination and Visual Motor Integration
GMD	Gross Motor Development
HFA	height-for-age
HFAZ	height-for-age Z score
SDG	Sustainable Development Goal
SE	standard error
SD	standard deviation
WHO	World Health Organisation

ACKNOWLEDGEMENTS

This first national Index of the extent to which 4- to 5-year-olds are *On Track* for development would not have been realised without the leadership and commitment of Sonja Giese, Executive Director of Innovation Edge at the time of this study, and the generous funding received from donors. The authors wish to thank Dr Jan Schenk, the CEO of ikapadata, and his fieldwork team for conducting the Thrive by Five data collection under the challenging conditions presented by the Covid-19 pandemic, and for providing us with the dataset used in our analyses. We are also most grateful to Dr Stephen Taylor, Professor Servaas van der Berg, Dr Janeli Kotzé and Grace Bridgman for providing the method used to weight the sample, and for their contributions to our process along the way. Finally, we thank the ELP staff and children who agreed to participate in the study.

Executive Summary

1. Introduction

For both policy and intervention purposes, there is a need for data that can be used to longitudinally monitor the quality of early childhood development (ECD) programme provision and Early Learning outcomes in children under 5 years. *Thrive by Five Index 2021* constitutes the first (baseline) in a series of nationally and provincially representative surveys that will monitor trends over time in the proportions of children 50-59 months who are *On Track* for their age in key areas of development.

The term *On Track* means that a child meets the expected standards for early development in the areas of *health, learning and Social-Emotional Functioning prior to 5 years of age.*

Data for the Index was collected between September and November 2021 by a team of trained assessors managed by ikapadata. Data collection took place prior to the ECD function shift from the Department of Social Development (DSD) to the Department of Basic Education (DBE). The findings can be used to support efforts to ensure that more children receive the nurturing care and services they need to help ensure their development is *On Track*, and to strengthen collective action to support those children who are not. In addition, the Index will permit monitoring of the country's progress towards attainment of Sustainable Development Goal (SDG) Target 4.2. The relevant SDG indicator is: 4.2.1: *The proportion of children under 5 years of age who are developmentally on track in health, learning and psychosocial well-being, by sex*. The indicators in Table 1 were used in analyses to assess the extent to which children were *On Track*.

Table 1: Thrive by Five Indicators

Indicator	Measure and definition
Learning	Measure: Early Learning Outcomes Measure 4&5 Years Assessment tool (ELOM 4&5)
Children's learning is *On Track*	Definition: Total and Domain scores[1] on the ELOM 4&5 fall at or above the 60th percentile of the ELOM 4&5 standard score distribution, established in 2016 (Total Scores range from 0-100; Domain scores range from 0-20)
Social-Emotional Functioning*	Measure: ELOM Social-Emotional Rating Scale (Teacher Assessment of children's social and emotional functioning)
Children's Social Relations are *On Track*	Definition: The Total Score on the ELOM 4&5 Teacher Assessment *Social Relations with Peers and Adults* scale ε18

[1] The ELOM 4&5 has 23 items clustered in five domains: Gross Motor Development; Fine Motor Coordination and Visual Motor Integration; Emergent Numeracy and Mathematics; Cognition and Executive Functioning; and Emergent Literacy and Language.

Children's Emotional Readiness for School is *On Track*	Definition: The Total Score on the ELOM 4&5 Teacher Assessment *Emotional Readiness for School Scal*e ε 9
Growth	Measure: Height was measured using a stadiometer
Normal Growth	Definition: The child's height-for-age Z score (HFAZ) falls between -2 and +2 standard deviations (SDs) of the World Health Organisation (WHO) reference group median

* Note: For regression analyses and some descriptions, the *Social Relations with Peers and Adults* and *Emotional Readiness for School* scales are combined into one measure of "*Social-Emotional Functioning*"

The Index sought to provide data to answer the following key questions for the country as a whole and for each province:

1. For learning outcomes overall (the ELOM 4&5 Total Score) – what proportion of children are *On Track* (achieving the expected developmental standard), *Falling Behind* the standard and *Falling Far Behind* the standard?
2. For each of the five ELOM 4&5 learning domains – what proportion of children are *On Track*, *Falling Behind* and *Falling Far Behind* the standard?
3. For the social-emotional domain – what proportion of children meet the expected score for their Social Relations with Peers and Adults, and their Emotional Readiness for School?
4. Height-for-age (HFA) – what proportion of children show normal growth or are stunted or severely stunted in their growth?

Supplementary questions that we addressed include:

5. What is the relationship between children's growth status and their performance on the ELOM 4&5?
6. What is the relationship between children's social and emotional status and their performance on the ELOM 4&5?
7. What is the relationship between performance on the ELOM 4&5 and the years a child has been enrolled in the programme, and their average attendance per week in the term preceding the data collection?

2. Index design and sampling

A multistage cluster sampling strategy was employed to recruit the sample and to permit disaggregation of findings by sex, province and school quintile. The sample consisted of a representative sample of children aged 50-59 months *enrolled in various types of Early Learning Programmes (ELPs)* included in the Vangasali crowd-sourced database[2]

[2] Vangasali. (2020). *Campaign: Finding every early childhood development (ECD) service to enable registration.* https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/vangasali_campaign.concept_note.pdf; Nelson Mandela Foundation. (2022). *Vangasali*. https://www.nelsonmandela.org/vangasali

and other available information. The sampling frame excluded mobile centres (problematic for geo-sampling) and pure toy libraries.

While the sample can provide a sound picture of children attending services, it cannot be regarded as reliably representative of all children in this age group, for two primary reasons: a) no official enumerated list of ELPs is available and some services attended by children may not have been included in the datasets used for sampling, and b) many children in this age group, particularly from lower income backgrounds, do not attend an ELP.[3]

The ikapadata dataset provided to the authors included 5,585 records of children assessed. Of these, 5,222 were judged to be valid cases with sufficient high-quality information to constitute the sample for analysis. The selected sample consists of children aged from 50-59 months (mean age = 54.74 months, SD = 2.7) from all nine provinces, of which 2,525 (48%) are boys and 2,697 (52%) are girls.[4] Note, however, that in the post-survey construction of sampling weights, an additional number of cases were excluded due to the absence of information required to construct the weights, so weighted analyses are computed on a total of 5,139 children grouped by province in Table 2, by school quintile in Table 3 and by home language in Table 4.

Table 2: Sample in each province

Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo
N = 587	N = 565	N = 571	N = 575	N = 578
Mpumalanga	**North West**	**Northern Cape**	**Western Cape**	
N = 540	N = 564	N = 600	N = 559	

[3] A separate exercise was undertaken to extrapolate findings to the full population of 4- to 5-year-old children in South Africa. This process is detailed in the technical supplement.

[4] Statistics South Africa 2019 mid-year population estimate: males constitute 51% and females 49% of the 0-5 years population. Source: Statistics South Africa. (2019). *Statistical release P0302: Mid-year population estimates 2019.* https://www.statssa.gov.za/publications/P0302/P03022019.pdf

Table 3: Sample by school quintile

Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
N = 1727 (33.6%)	N = 1250 (24.3%)	N = 1144 (22.3%)	N = 495 (9.6%)	N = 523 (10.2%)

Table 4: Sample by home language

Afrikaans	English	isiXhosa	isiZulu	Tshivenda	Setswana
N = 419 (8%)	N = 404 (8%)	N = 791 (15%)	N = 917 (18%)	N = 135 (3%)	N = 1091 (21%)
Sesotho	**siSwati**	**Xitsonga**	**isiNdebele**	**Sepedi**	
N = 561 (11%)	N = 192 (4%)	N = 132 (3%)	N = 75 (1%)	N = 505 (10%)	

Note: numbers in this table are based on the dataset before including the weighting variable.

Home languages for the total population in 2018 are reported by Statistics South Africa.[5]

2.1. Weighting

Sampling weights were constructed by first determining a stratification weight for province and quintile (based on the number of primary schools sampled relative to the total number of primary schools in Province-Quintile combinations). This weight was multiplied by a second weight that was constructed as a relative weight for each centre sampled in an ECD programme cluster multiplied by the estimated population size of the cluster sampled in the data collection phase. Population size of cluster was estimated by proxy from the number of Grade 3 enrolments in the closest primary or combined school. A comprehensive account of the construction of sampling weights is given in the Appendices. Weighting was also applied for analyses undertaken by Van der Berg and Bridgman when extrapolating the findings to the population of those aged 50-59 months as a whole. This is provided in a separate report.

2.2. Thrive By Five Composite Index

The Thrive by Five Index was constructed for use at national level. It comprises two equally weighted indicators: Stunting (including severe stunting) and ELOM 4&5 Total Score. These were chosen as they are both based on objective, standardised measures and both are crucial for monitoring children's health and development prior to

[5] Home languages: Afrikaans = 12.2%; English = 8.1%; isiNdebele = 1.6%; isiXhosa = 14.8%; isiZulu = 25.3%; Sepedi = 10.1%; Sesotho = 7.9%; Setswana = 9.1%; siSwati = 2.8%; Tshivenda = 2.5%; Xitsonga = 3.6%. Source: Statistics South Africa. (2018). *Statistical release P0318: General Household Survey 2018*. https://www.statssa.gov.za/publications/P0318/P03182018.pdf

entering the Foundation Phase of school. Teacher ratings of Social- Emotional Functioning were considered for inclusion but were rejected, as these ratings are subjective and potentially biased, and also because there are high numbers of missing values in these indicators.

The Composite Index describes the proportions of children who fall into one of the following three categories:

1. Children who are thriving (*On Track* in both growth and learning);
2. Children who face barriers to thriving (*On Track* for only one of either growth or learning); and
3. Children who face significant barriers to thriving (not *On Track* for both growth and learning).

3. Key findings

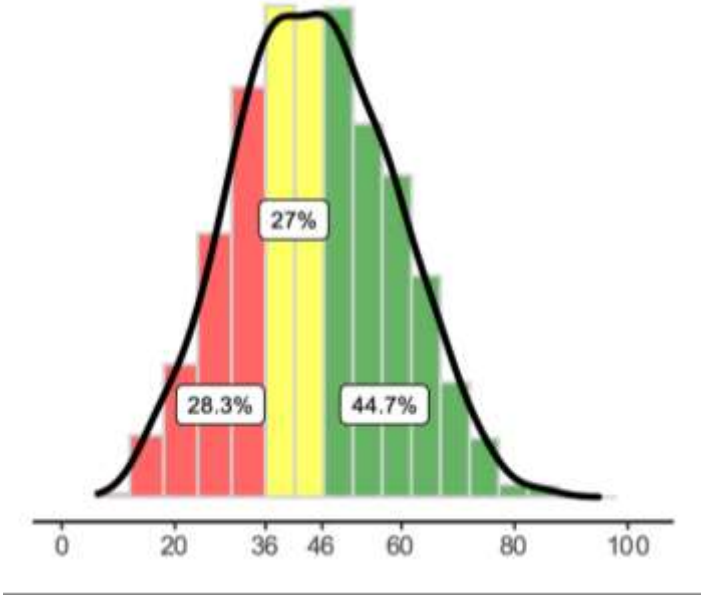


Figure 1: National level total ELOM 4&5 distribution (N = 5139)

Figure 1 shows the distribution of Total ELOM 4&5 Scores (i.e., summed over all the domains) for the 5,139 children in the weighted sample, colour-coded to indicate the proportion of children *On Track* (green), *Falling Behind* the standard (yellow) and *Falling Far Behind* the standard (red).

On the basis of the normative scores[6] for the ELOM 4&5:

- 44.7% of children who attend ELPs in South Africa are achieving the standard (are *On Track*);
- 27% are *Falling Behind*; and

[6] As per the standard set in 2016 in consultation with technical experts, following a review of other assessment tools, research literature, South African policy, *The South African National Curriculum Framework for Children from Birth to Four* and expert opinion on abilities and knowledge deemed essential for readiness to learn in Grade R and for the skills known to be associated with academic achievement in the Foundation Phase (Grades 1, 2 and 3).

- 28.3% are *Falling Far Behind*.

There were significant differences in mean ELOM 4&5 Total Scores across school quintiles (a proxy for the child's socio-economic background), although there was also considerable overlap in the distribution of scores between quintiles. The proportions *On Track* across the five quintiles indicate a socio-economic gradient with greater proportions of children from the higher quintile backgrounds being *On Track*. The mean scores and SDs of the Total ELOM 4&5 Scores across the quintiles give a good sense of differences and overlap, as well as the extent of variation within each quintile (SD):

- Quintile 5: 58.1% *On Track* (mean ELOM 4&5 Total Score = 49.3; SD = 14.66).
- Quintile 4: 48.2% *On Track* (mean ELOM 4&5 Total Score = 45.39; SD = 14.36).
- Quintile 3: 43.1% *On Track* (mean ELOM 4&5 Total Score = 44.19; SD = 13.16).
- Quintile 2: 44% *On Track* (mean ELOM 4&5 Total Score = 44.21; SD = 13.51).
- Quintile 1: 38.4% *On Track* (mean ELOM 4&5 Total Score = 42.68; SD = 13.27).

The ELOM 4&5 Total Score is summed across five domains, but it is useful to consider the distribution of children *On Track*, *Falling Behind* or *Falling Far Behind* the standard, in each of the domains. These are reported as follows, with the percentages *On Track* (bolded), *Falling Behind* and *Falling Far Behind* the standard listed after the domain name:

- Gross Motor Development (GMD): **48.3%**, 24.4%, 27.3%
- Fine Motor Coordination and Visual Motor Integration: **30.4%**, 34.5%, 35.1%
- Emergent Numeracy and Mathematics (ENM): **33.9%**, 31.1%, 35%
- Cognition and Executive Functioning (CEF): **41.4%**, 32.1%, 26.5%
- Emergent Literacy and Language (ELL): **54.7%**, 26%, 19.3%

It appears that South African children attending this sample of known ELPs are doing better in terms of literacy standards than in other domains. The low percentages *On Track* for the others, all of which are associated with performance in the Foundation Phase and beyond, are of considerable concern.

Regarding children's social and emotional readiness for school:

- 72.5% were *On Track* in terms of *Social Relations with Peers and Adults*, and 66.6% were *On Track* in terms of *Emotional Readiness for School*.

These findings are positive, as both are associated with adjustment to the school environment.

A very important physical indicator of child health in the age group in question is whether they have attained appropriate growth for their age. This WHO reference standard (HFAZ) was computed for the sample:

- 94.36 % of children were of normal HFA;
- 5.12 % had moderately stunted growth; and

- 0.53 % had severely stunted growth.

Overall, 5.65% of the children in this national survey of children attending ELPs were identified as having stunted growth (HFAZ below 2 Standard deviations from the median of the WHO reference population). It remains to be determined whether stunting rates for children who are *not enrolled* in ELPs are significantly different from our finding.

Child-level correlates of performance on the ELOM 4&5 Total Score (predictors) were investigated, and a number of factors were identified as being statistically significant and substantive correlates. Some were clearly of considerable weight when controlling for other factors. We found that the factors most strongly related to performance on the ELOM 4&5 were:

- age of child (important, if obvious), growth status of child (if of normal or stunted growth), socio-economic status (as indexed by school quintile), sex of child, and the social and emotional functioning of the child.
- We also found some evidence that the amount of time (years) children had spent in the ELPs was correlated to their Total ELOM 4&5 Score.

4. To what extent are South African children aged 50-59 months *On Track*?

Research reviewed for this study has consistently found that by 50-59 months of age, language and mathematics skills, executive functioning, fine motor coordination and visual motor functioning are predictive of children's performance in the Foundation Phase of their schooling. ELL and mathematics abilities are highly predictive of later success in these areas. Social and emotional development are both predictive of adjustment to school and to achievements in the primary phase, but to a lesser extent.

Analysis of ELOM 4&5 Total Scores in this study shows that the development of *less than 50%* of South African children attending known ELPs is *On Track* for transition to Grade R. In line with the international literature, *girls outperform boys*, with 9% more achieving the ELOM standard.

In line with other studies of the relationship between socio-economic background and indicators of school readiness, a clear socio-economic gradient is evident. Almost 60% of children in quintile 5 are *On Track* for Early Learning (they achieve the ELOM 4&5 Total Score standard), while less than 40% of children in quintile 1 are. Of particular concern is that between 28% and 32% of children in quintiles 1 to 4 are *Falling Far Behind* the ELOM standard despite participating in an ELP.

Regarding ELOM 4&5 domains assessed directly, only in the ELL domain are more than 50% (54.7%) of children achieving the expected standard. Of particular concern is poor performance in Fine Motor Coordination and Visual Motor Integration (FMC-VMI), where only 30.4% achieve the standard. Almost 34% (33.9%) achieve the standard in ENM, while just over 41% (41.4%) do so in the CEF domain and 48% (48.3%) do so in GMD. Again, socio-economic gradients are starkly evident in these domains, showing that poorer children are significantly disadvantaged as they proceed to school. The skills gap between wealthier and poorer children is likely to endure

and impact on school achievement in a number of areas, but particularly in mathematics. That said, and as will be apparent from the main report that follows, in all quintiles there is considerable variation in the performance of individual children on the ELOM 4&5. Being of lower socio-economic status does not necessarily mean that a child will not be *On Track* – a proportion of children in all three of the lower quintiles achieves the ELOM 4&5 standard.

It is encouraging that children are doing relatively well in the social and emotional domains which are both expected to assist transition to formal schooling and enable learning. More than 70% of children's teacher ratings of their Social Relations with Peers and Adults are at the expected level, and 65% of children are at the expected level for their Emotional Readiness for School.

5. What is their growth status?

HFA is predictive of the sorts of skills measured on the ELOM 4&5. We classified children as being of normal growth, stunted (>2 SDs below the WHO reference group median) or severely stunted (>3 SDs below the WHO median).

We found that 5.65% of children nationally are either moderately stunted (5.12%) or severely stunted (0.53%). Provinces vary, but those where children's health and development is most compromised reside in the Eastern Cape, where 9.98% are either stunted or severely stunted, and the Free State and Limpopo (more than 7.49% in both provinces).

The figures reported here include only moderately and severely stunted children. This is in line with most policy-related research on child growth, which focuses on the implications for development of moderate and severe growth stunting. But as Stevens et al. (2012, p.824)[4] point out, "the hazardous effects of undernutrition happen along a continuum of mild, moderate, and severe undernutrition." The implication is that mild stunting (HFAZ below 1 Standard deviation of the median of the WHO reference population) should not be ignored as it could be a barrier to thriving.

Almost one in five children in the Thrive by Five sample showed signs of mild stunting.

Chronic malnutrition is taking its toll on South African children – particularly those from poorer backgrounds. As a result, the neurological and cognitive development of large numbers of children nationally and in particular provinces is likely being compromised. While a proportion may recover to normal growth in the coming few years, the long-run negative impact of this readily preventable condition on the human capital of the country must be emphasised.

6. Predictors of performance on the ELOM 4&5

What is associated with ELOM 4&5 Total Scores? Our investigation of predictors of ELOM 4&5 Total Scores (using multiple regression analyses) provides insight into the manner in which different variables measured in the study are associated with this outcome. As we report, this was only investigated at national level, as it was at that level that maximum statistical power was available. We stress that these findings cannot be seen as uncovering causal

relationships, as they are based on cross-sectional data, and we did not use post-hoc methods of uncovering causal relationships.

We found that children's age, sex, socio-economic status (quintile proxy), fees paid, growth status (normal, stunted and severely stunted), and social and emotional development, and the extent of their exposure to an ELP (years and attendance), were all positively and significantly correlated with their ELOM 4&5 Scores.

A mixed linear model was used to test and quantify the extent to which the predictors we identified were related uniquely to the Total ELOM 4&5 Score, once taking all other predictors into account.

- The results of the model show that moderate and severe growth stunting has a strong impact on the Total ELOM 4&5 Score. Specifically, the std. β coefficient for the difference between children who are "moderately stunted" and those with "normal HFA" is -0.37 (the coefficient for severely stunted children is similar, but less reliable, given a small cell size). Even mild stunting has a significant and substantial relationship with the Total Elom 4&5 score (std β = -0.17).
- Socio-economic status (measured in our sample by quintile score[7]) has a similarly large impact on the Total ELOM 4&5 Score. Differences vary by quintile, but one can see stark differences between children in lower and upper quintiles, particularly between children in quintile 1 and those in quintile 5 (std. β = 0.61) and between children in quintile 1 and those in quintile 4 (std. β = 0.33).
- Social-Emotional Functioning has a surprisingly strong effect on Total ELOM 4&5 Scores (std. β = 0.33). This is followed in strength by the effects for age, and finally sex.
- Together, when variation due to cluster sampling is taken into account, these predictors explain 51% of variation in Total ELOM 4&5 Scores (21% if considering only the fixed effects) – a significant and substantial proportion.

7. Thrive By Five Composite Indicator

The Thrive by Five Composite Indicator describes the proportions of children *On Track* for growth and achieving the ELOM 4&5 standard. It includes three categories:

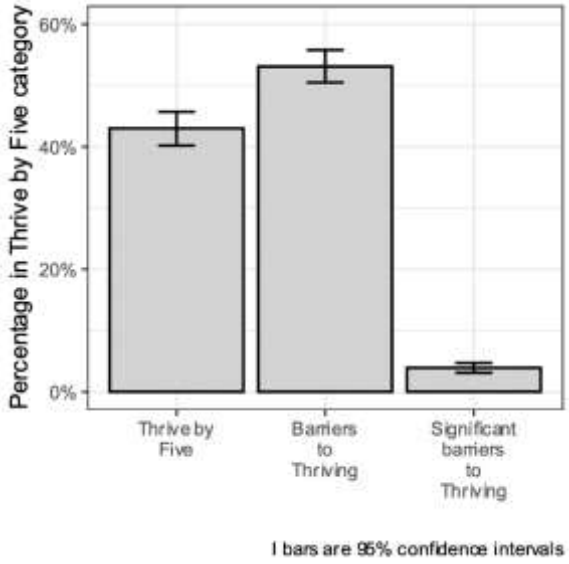
1. Children who **Thrive by Five:** These children are *On Track* for both Early Learning and physical growth.
2. Children who face **Barriers to Thriving:** These children are *On Track* in only one of these areas – either learning or growth.
3. Children who face **Significant Barriers to Thriving:** These children are Not *On Track* for both Early Learning and growth.

[7] We used an alternate definition of quintile (natemis) for the modelling of the Total ELOM 4&5 score, as discussed later in the report.

This is illustrated for the national level in Table 5 below.

Table 5: Index table for Total ELOM 4&5 Score

Indicator status	Percentage	95% lower CI	95% upper CI
Thriving by Five	42.95%	40.29%	45.66%
Barriers to Thriving	53.13%	50.46%	55.80%
Significant barriers to Thriving	3.92%	3.11%	4.73%



8. Comment on findings

It is important to note that the children whose development was assessed in this study were all in some form of ELP and were assessed in the final term of the year. By that point, as many as possible should be achieving the ELOM 4&5 standard for the test as a whole and for all the domains.

However, these children have not had the benefit of a normal ELP year. The Covid-19 pandemic has significantly affected the ECD service sector. Closures of ELPs during various lockdown periods (particularly in 2020)[8] significantly disrupted the amount of programme participation possible for children. In addition, at the time of the fieldwork for this study, crèches and preschools remained subject to standard operating procedures required by the DSD to manage risks of infection. The impact of the pandemic and associated changes to the daily programmes of ELPs have likely changed the nature of the child's experience in several ways and in all probability reduced the

[8] Wills, G. & Kika-Mistry, J. (2021). *Early Childhood Development in South Africa during the COVID-19 Pandemic: Evidence from NIDS-CRAM Waves 2 – 5*. https://cramsurvey.org/wp-content/uploads/2021/07/14.-Wills-G-_-Kika-Mistry-J.-2021-Early-Childhood-Development-in-South-Africa-during-the-n-COVID-19-pandemic-Evidence-from-NIDS-CRAM-Waves-2-5.pdf

amount of benefit they might normally have gained. In addition, for all children, but particularly those in the lower three school quintiles, the impact of the pandemic on livelihoods, household resources and caregiver wellbeing has likely impacted on the health and development of young children.

As a result, one cannot regard the findings of this Index as reflecting children's development under normal societal conditions. However, as we do not have representative data on the pre-pandemic under-5 population, we cannot say whether these findings represent a "Covid-19" effect. That judgement must await comparison with future survey rounds.

Introduction

The report proceeds from a brief consideration of the literature on early childhood predictors of later school performance. Thereafter the study questions, survey design, sample and findings are presented for the country as a whole and then for each province.

1. Early abilities and later school performance

In this section, we briefly present the evidence for *key* predictors of children's early academic outcomes. We do not present a comprehensive literature review. Most of the research to which we refer below is from high-income countries, as there is limited evidence available in the Global South.

It is important to recognise that development in the early years is uneven, with some abilities emerging prior to others, as illustrated in Figure 2.

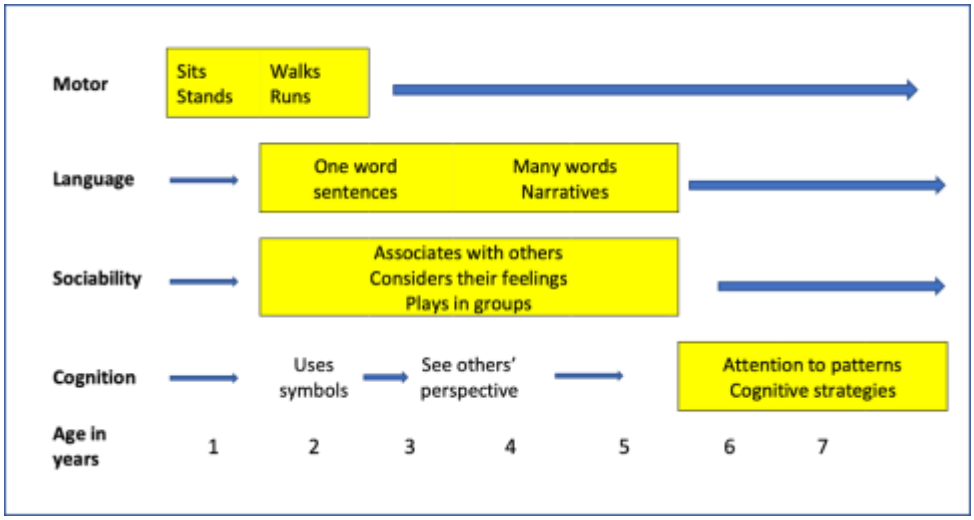


Figure 2: The uneven pace of development with rapid progress at different times in different domains. Source: Dawes et al. (2004)[9]

At an individual level, some children will be behind others in one area but ahead in another. Socio-economic status and the quality of the early home learning environment have major influences on the health, psychological development and later academic achievement of children. Internationally it is seen that those from wealthier home backgrounds outperform their more disadvantaged counterparts, particularly on tests of literacy and language, numeracy and mathematics, and cognitive abilities (Boyden et al., 2018; Duncan et al., 2007; Duncan et al., 2010; Letourneau et al., 2013; Tran, Luchters & Fisher, 2017).[10]

---

[9] Dawes, A., Bray, R., Kvalsvig, J., Rama, S., & Richter, L. (2004). *Indicators of South African children's psychosocial development in the early childhood period. Phase 1 & 2 Report for UNICEF South Africa*. Cape Town: Human Sciences Research Council. http://www.hsrc.ac.za/en/research-outputs/view/1258

[10] Boyden, J., Dawes, A., & Tredoux, C. G. (2018). Improving children's chances: Using evidence from four low- and middle-income countries to set priorities for the SDGs. In S. Verma, & A. Petersen (eds), *Sustainable Development Goals: Using Developmental Science to Improve Young Lives Globally*. Springer.

Duncan, et. al. (2007). School readiness and later achievement. *Developmental Psychology*, 44(1), 1428-1446.

Duncan, G. J., Ziol-Guest, K. M., & Kalil, A. (2010). Early-childhood poverty and adult attainment, behaviour, and health. *Child Development*, 81(1), 306–325.

South African studies using the Early Learning Outcomes Measure (ELOM 4&5, the measure of child development used in this study) also show similar differences related to socio-economic circumstances in children aged 50-59 months for all domains, but most markedly for ELL and CEF (see the ELOM Technical Manual; Dawes, et al., 2020).[11]

It is important to recognise that the skills in different domains do *not* develop independently, but rather influence one another. For example, early language abilities will affect a child's understanding of the instructions that must be followed to solve a mathematics problem. Similarly, the ability to construct groups from a mixed assortment of objects (one of the ELOM 4&5 ENM items) involves a range of skills including the (cognitive) ability to distinguish between different classes and subclasses of objects. That skill in turn is dependent on the ability to perceive differences in shape, size, colour and function (ELOM 4&5 numeracy and mathematics items). Short-term and working memory are executive functions that are required to solve most problems, but they can be disrupted by poor emotional regulation and anxiety (which are assessed in this study by the ELOM 4&5 Emotional Readiness for School scale). The child's ability to work collaboratively with peers and with practitioners (assessed in this study with the ELOM 4&5 Social Relations with Peers and Adults scale) will affect the extent to which early learning benefits from such engagements.

Other literature to which we refer below points to the importance of cognitive development (including executive functioning) and visual motor and perceptual skills for both early language and literacy, and early mathematics abilities. Gross Motor Development and social and emotional functioning are particularly important in the transition to Grade R. Motor development has also been found to have a social and emotional benefit in the primary phase of schooling, as motor competence facilitates peer engagement through participation in games, and is associated with emotional wellbeing as well as with academic achievement (Kamphorst et al., 2021; Pagani & Meisser, 2012).[12]

One of the most rigorous and comprehensive meta-analytic studies of the influence of early abilities and social-emotional functions on later school achievement was conducted by Duncan et al. (2007).[13] In that analysis, six American, British and Canadian longitudinal datasets were used to model outcomes. Children were first assessed between 54 and 72 months of age. The strongest predictors at school entry were *emergent mathematics skills*, *early reading ability* and ability to pay *attention* (assessed through teacher reports). No relationship between measures of emotional and behavioural difficulties and later school

---

Letourneau, N. L., Duffett-Leger, L., Levac, L., Watson, B., & Young-Morris, C. (2013). Socioeconomic status and child development: A meta-analysis. *Journal of Emotional and Behavioral Disorders*, *21*(3), 211–224. https://doi.org/10.1177/1063426611421007

Tran, T. D., Luchters, S., & Fisher, J. (2017). Early childhood development: impact of national human development, family poverty, parenting practices and access to early childhood education. *Child: Care, Health and Development*, *43*(3), 415-426.

[11] Dawes, A., Biersteker, L., Girdwood, E., Snelling, M. J. T. L., Tredoux, C. G. et al. (2020). *Early Learning Outcomes Measure (ELOM) Technical Manual.* Claremont, Cape Town: The Innovation Edge. http://elom.org.za/wp-content/uploads/2020/06/ELOM-Technical-Manual_2020.pdf

[12] Kamphorst, E., Cantell, M., Van Der Veer, G., Minnaert, A. & Houwen, S. (2021). Emerging School Readiness Profiles: Motor Skills Matter for Cognitive and Non-cognitive First Grade School Outcomes. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.759480

Pagani, L. S., & Messier, S. (2012). Links between motor skills and indicators of school readiness at kindergarten entry in urban disadvantaged children. *Journal of Educational and Developmental Psychology*, *2*(1), 95–107. doi: 10.5539/jedp.v2n1p95

[13] Duncan, G. J., Claessens, A., Huston, A.C., Pagani, L.S., et al. (2007) School readiness and later achievement. *Developmental Psychology, 44*, 1428-1446.

achievement was apparent, but more recent studies cast doubt on this conclusion. A major contemporary study of some 33,000 American children attending public pre-K by Ricciardi et al. (2021)[14] investigated the extent to which a range of preschool abilities assessed at age 4 years predicted school achievement in Grade 5. Cognitive, language and fine and gross motor functioning at this age were significantly related to academic performance in Grade 5, along with Social-Emotional Functioning measures, although these had smaller effects. Nonetheless, it was evident that Social-Emotional Functioning "exerted a continual influence on later academic success" (p. 118).

When considering predictors of later academic outcomes from preschool assessments on tools such as the ELOM 4&5, it is important to distinguish between skills and traits that enable the child to transition to Grade R and skills that studies have shown to predict later academic performance. This was taken into account when the ELOM 4&5 was developed: Domains and items included in the ELOM 4&5 were informed by research literature, South African policy, the 0-4 curriculum, and expert opinion on abilities and knowledge deemed essential for a) readiness to learn in Grade R, and b) the foundational skills known to be associated with academic achievement in the Foundation Phase.

In what follows, our focus is on the relationship between children's abilities and functioning in specific domains prior to entering formal schooling, and their later academic performance. As will be evident, domains are not functionally independent ("silos"), but affect one another. This is particularly the case for skills assessed in the CEF, FMC-VMI and social-emotional domains of the ELOM 4&5.

1.1. Cognition and Executive Functioning

Behavioural and emotional regulation are important features of executive functioning (EF). With neurological maturation and ongoing socialisation, improved attention, concentration and emotional evenness are apparent, increasing the benefit from learning opportunities in the classroom and other environments. Enhanced EF also allows more capable, active and flexible manipulation of information using rules, working memory and other cognitive facilities (Nayfeld et al., 2013).[15] These cognitive skills operate across domains, allowing for "conscious, goal-directed control of thoughts and actions" (Baptista et al., 2016, p. 22),[16] and the ability to solve novel problems, in contrast to using lower-level skills such as letter and numeral recognition or production and simple arithmetic tasks.

Research on EF is proving helpful in identifying capacities that underpin both early mathematics and literacy abilities in the Foundation Phase. As Fitzpatrick et al. (2014, p. 25)[17] note, as children reach school age "executive function skills can help

[14] Ricciardi, C., Manfra, L., Hartman, S., Bleiker, C., Dineheart, L., and Winsler, A. (2021). School readiness skills at age four predict academic achievement through 5th grade. *Early Childhood Research Quarterly, 57*, 110–120. doi: 10.1016/j.ecresq.2021.05.006

[15] Nayfeld, I., Fuccillo, J., & Greenfield, D. B. (2013). Executive functions in early learning: Extending the relationship between executive functions and school readiness to science. *Learning and Individual Differences*, *26*, 81-88.

[16] Baptista, J., Osório, A., Martins, E. C., Verissimo, M., & Martins, C. (2016). Does social-behavioral adjustment mediate the relation between executive function and academic readiness? *Journal of Applied Developmental Psychology, 46*, 22-30.

[17] Fitzpatrick, C., McKinnon, D., Blair, C. B., & Willoughby, M. T. (2014). Do preschool executive function skills explain the school readiness gap between advantaged and disadvantaged children? *Learning and Instruction, 30*, 25–31. http://dx.doi.org/10.1016/j.learninstruc.2013.11.003

[them] hold information or instructions in mind during classroom activities, focus on task-relevant stimuli during problem-solving tasks, and resist internal or external distractions".

Studies in high-income countries commonly find a social gradient for EF, with poorer children performing worse than their wealthier counterparts. Research using the ELOM 4&5 reports similar findings. (See the ELOM Technical Manual). However, a recent South African study using different measures of EF tells another story. Howard et al. (2020)[18] found that very disadvantaged South African preschool children outperformed Australian children from higher socio-economic strata on tests of working memory and cognitive flexibility. The reasons for these surprising findings are not clear.

1.2. Early Numeracy and Mathematics

Early mathematics skills are strongly predictive of later school success – more so than language ability (Duncan et al., 2007; Siegler et al., 2012).[19] In Duncan's meta-analytic study, knowledge of numbers and ordinality on school entry were the most powerful predictors of later mathematics achievement.

Foundational components for mathematics learning include the ability to name symbols used to represent numerosity (numerals) and discriminate between two quantities as represented by sets or numerals. These components also include the ability to detect number patterns, perform the operations of addition and subtraction, and apply these skills to real-life situations, generally assessed through word problems (Geary, 2011).[20] The ability to identify numerals grows over the early childhood years and has also been shown to be predictive of later mathematics abilities (Chard et al., 2005).[21] Oral counting fluency and number identification are known as "gateway skills" and are comparable to letter-naming fluency measures in assessing reading ability.

Duncan and colleagues did not examine the role of fine motor skills in predicting school achievement. Studies since then have established that fine motor skills and visual-spatial abilities in 5-year-olds make a specific contribution to mathematics skills by the end of Grade 2 (e.g., Pagani & Messier, 2012). These latter authors note that:

> "…early math skills were strongly related to both fine motor and perceptual-motor abilities. The relationship with fine motor ability is likely influenced by the fact that early informal knowledge of numbers is generated by manipulating objects and exploring their properties" (p. 101).

Components of executive functioning – verbal working memory, short-term memory, inhibitory control and planning abilities (including flexible use of rules) – as assessed by the ELOM 4&5 are all associated with mathematics skills in 5- to 6-year-old

---

[18] Howard, S. J., Cook, C. J., Everts, L., Melhuish, E., Scerif, G., Norris, S., Twine, R., Kahn, K., & Draper, C. E. (2020). Challenging socioeconomic status: A cross-cultural comparison of early executive function. *Developmental Science*, 23(1), https://doi.org/10.1111/desc.12854

[19] Siegler, R. S., Duncan, G. J., Davis-Kean, P. E., Duckworth, K., Claessens, A., Engel, M., Susperreguy, M. I., and Chen, M. (2012) Early predictors of high school mathematics achievement. *Psychological Science, 23*(7), 691-697.

[20] Geary, D. C. (2011). Cognitive Predictors of Achievement Growth in Mathematics: A Five Year Longitudinal Study. *Developmental Psychology, 47*(6), 1539–1552.

[21] Chard, D. J., Clarke, B., Baker, S., Otterstedt, J., Braun, D., & Katz, R. 2005. Using measures of number sense to screen for difficulties in mathematics: preliminary findings. *Assessment for Effective Intervention, 30*(2), 3–14.

children (Bull et al., 2001; Gunderson, et al., 2012; Le Fevre et. al., 2010).[22] The use of measurement vocabulary relating to size in the early years (as measured on the ELOM 4&5) is predictive of later spatial problem-solving tasks (Pruden et al., 2011).[23] Of interest is that significant correlations (Pearson coefficients ranging between 0.22 and 0.45) have been observed between ELOM 4&5 numeracy scales (counting and addition/subtraction) and three ELOM 4&5 EF measures (Pencil Tapping, Puzzle Completion and the Dimensional Card Sort task). These measure inhibitory control, working memory and problem-solving. The strongest relationship was with Pencil Tapping, which assesses working memory, inhibitory control and attention.

Attention-related skills such as task persistence and self-regulation are expected to increase the time during which children engage and participate in academic endeavours. The ability to control and sustain attention as well as participate in classroom activities is known to predict achievement test scores and grades during preschool and the early elementary grades. Likewise, mastery of foundational concepts of numbers allows for a deeper understanding of more complex mathematical problems and flexible problem-solving techniques (e.g., Baroody, 2016).[24]

1.3. Literacy and language

Research on how children acquire reading skills points to both the importance of specific academic skills and also to the role of cognitive and conceptual abilities, and oral language. Those who have an opportunity to read early clearly have an advantage, as early reading ability is the most powerful predictor of reading ability in middle childhood (Duncan et al., 2007).

Basic oral language skills become critical for understanding texts as the level of difficulty of reading passages increases. Emergent early childhood literacy skills identified as strong predictors of later literacy achievement include: a large vocabulary, being capable of explanatory talk, demonstrating some letter identification before age 5, understanding narrative and story, understanding writing functions, knowing nursery rhymes and demonstrating phonological awareness (O'Carroll and Hickman, 2012; Strickland and Riley-Ayers, 2006).[25] Skills related to print knowledge, phonological processing and oral language are fundamental and independent predictors of later literacy development (National Early Literacy Panel, 2008).[26]

---

[22] Bull, R., & Scerif, G. (2001). Executive functioning as a predictor of children's mathematics ability: Inhibition, switching, and working memory. *Developmental Neuropsychology, 19*(3), 273-293

Gunderson, E. A., Ramirez, G., Beilock, S. L., & Levine, S. C. 2012. The relation between spatial skill and early number knowledge: the role of the linear number line. *Developmental Psychology*, 48(5), 1229–41

LeFevre, J.-A., Fast, L., Skwarchuk, S.-L., Smith-Chant, B. L., Bisanz, J., Kamawar, D., & Penner-Wilger, M. (2010). Pathways to mathematics: Longitudinal predictors of performance. *Child Development, 81*(6), 1753-1767.

[23] Pruden, S. M., Levine, S. C., & Huttenlocher, J. 2011. Children's spatial thinking: Does talk about the spatial world matter? *Developmental Science, 14*, 1417–30

[24] Baroody, A. J. (2016). Using number and arithmetic instruction as a basis for fostering mathematical reasoning. In M. T. Battista (Ed.), *Reasoning and sense making in the mathematics classroom: Pre-K-Grade 2* (pp. 27–69). Reston, VA: National Council of Teachers of Mathematics.

[25] O'Carroll, S., & Hickman, R. (2012). Narrowing the literacy gap: Strengthening language and literacy development between birth and six years for children in South Africa. Wordworks: Cape Town.

Strickland, D., & Riley-Ayers, S. (2006) Early literacy: Policy and practice in the preschool years. National Institute for Early Education Research at Rutgers University, *Policy Brief.* http://www.readingrockets.org/article/early-literacy-policy-and-practice-preschool-years.

[26] National Early Literacy Panel (NELP) (2008). *Developing early literacy: Report of the National Early Literacy Panel.* Washington, DC, National Institute for Literacy. http://lincs.ed.gov/publications/pdf/NELPReport09.pdf

Phonological awareness is one of the most researched early literacy skills. It is consistently found to predict the acquisition of later word-reading skills in every language in which it has been studied (Papadimitriou & Vlachos, 2014).[27] Letter knowledge has been consistently shown to be a strong predictor of early reading. Letter identification is the strongest predictor among reading readiness skills of later literacy achievements, such as decoding, spelling and reading comprehension skills (Burgess & Lonigan, 1998; McBride-Chang, 1999; National Early Literacy Panel, 2008; Scarborough, 1998; Schatschneider et al., 2004; Wagner et al., 1994).[28] Orthographic knowledge is also fundamental and refers to understanding about words in their written form. It includes the knowledge that certain sequences of letters compose words that represent spoken sounds.

Many of the skills required for formal learning of reading and writing involve specific visual motor abilities. Visual motor integration and eye-hand coordination have been shown to be independent predictors for handwriting ability (e.g., Tseng & Murray, 1994).[29] Pagnani and Messier (2012) argue that "In addition to gross and fine motor skills … visual perceptual skill should be regarded to be among the most significant factors related to math and reading achievement" (p. 97).

In sum, literacy skill acquisition is strongly underpinned by perceptual motor skills of the kind assessed in ELOM 4&5, including spatial awareness and orientation, and auditory, visual and temporal sensory awareness (Excell & Linington, 2011, Joubert et al., 2015).[30]

A recent study of socio-economically disadvantaged Grade 1 learners in the Western Cape has identified difficulties in these areas as major barriers to literacy (Wildschut et al., 2016).[31]

1.4. Social and emotional functioning

Children's social and emotional functioning is associated with successful transitioning to school (Arnold et al., 2012; Collie et al., 2019; Denham et al., 2012).[32] Key competencies predictive of adjustment include self-control, persistence, mastery

---

[27] Ibid

[28] Burgess, S. R., & Lonigan, C. J. (1998). Bidirectional relations of phonological sensitivity and prereading abilities: Evidence from a preschool sample. *Journal of Experimental Child Psychology*, *70*(2), 117-141.

Lonigan, C. J., Schatschneider, C., Westberg, L., & NELP (2008). Identification of children's skills and abilities linked to later outcomes in reading, writing, and spelling. *Developing early literacy: Report of the National Early Literacy Panel.* Washington, DC, National Institute for Literacy, pp. 55–106.

Scarborough, H. 1998. Predicting the future achievement of second graders with reading disabilities: contributions of phonemic awareness, verbal memory, rapid naming, and IQ. *Annals of Dyslexia, 48*, 115–136.

Schatschneider, C., Fletcher, J. M., Francis, D. J., Carlson, C. D. & Foorman, B. R. (2004). Kindergarten prediction of reading skills: a longitudinal comparative analysis. *Journal of Educational Psychology, 96(*2), 265–82.

[29] Tseng, M. H., & Murray, E. A. (1994). Differences in perceptual-motor measures in children with good and poor handwriting. *Occupational Therapy Journal of Research, 14*(1) 19-36.

[30] Excell, L., & Linington, V. (2011) Move to literacy: Fanning emergent literacy in early childhood education in a pedagogy of play. *South African Journal of Childhood Education, 1*(2) 27 – 45.

Joubert, I. (Ed) (2015) *Literacy in the Foundation Phase.* Revised Second Edition. Pretoria: Van Schaik.

[31] Wildschut, Z., Moodley, T., & Aronstam, S. (2016), The baseline assessment of Grade 1 learners' literacy skills in a socio-economically disadvantaged school setting, *South African Journal of Childhood Education 6*, 1-9.

[32] Arnold, D. H., Kupersmidt, J. B., Voegler-Lee, M. E., & Marshall, N. (2012). The association between preschool children's social functioning and their emergent academic skills. *Early Childhood Research Quarterly*, *27*(3), 376-386.

orientation, academic self-efficacy and social competence (Child Trends, 2014).[33] Whether children have sufficient confidence and focused attention to engage with learning materials, whether they can engage in the cooperative behaviours required for learning in groups, and whether their emotional maturity affects their ability to deal with learning challenges and form positive relationships with peers and teachers are all important indicators of social and emotional readiness to learn in the early years of school.

The study by Ricciardi et al. (2021) referred to earlier points to the influence of Social-Emotional Functioning on academic outcomes from preschool through the primary phase. In another recent study, temperament has been found to moderate performance in both language and mathematics achievement (Valiente et al., 2021).[34] These robust new findings in a previously under-researched area point to the cross-cutting importance of early childhood psychological wellbeing for overall performance in primary school.

1.5. Stunting (low height-for-age)

Growth stunting or linear growth faltering (i.e., when the height of a child is two or more SDs below the WHO reference norm) is a chronic (long-term) condition that is a reflection of the overall poor health status of the child and is known to compromise neurological and cognitive development. Stunting is a significant problem in South Africa. In 2016, 27% of children under 5 years of age were estimated to be stunted (Hall et al., 2019).[35] This is a probable significant loss of potential, with major consequences for the affected children and for the human capital of the country. Determinants of stunting are illustrated in Figure 3.

Collie, R. J., Martin, A. J., Nassar, N., & Roberts, C. L. (2019). Social and emotional behavioral profiles in kindergarten: A population-based latent profile analysis of links to socio-educational characteristics and later achievement. *Journal of Educational Psychology, 111*(1), 170-187. http//dx.doi.org/10.1037/edu0000262

Denham, S. A., Bassett, H., Mincic, M., Kalb, S., Way, E., Wyatt, T., & Segal, Y. (2012). Social-emotional learning profiles of preschoolers' early school success: A person-centered approach. *Learning and Individual Differences, 22,* 178–189. http://dx.doi.org/10.1016/j.lindif.2011.05.001

[33] Child Trends (2014). Measuring elementary school students' social and emotional skills. Providing educators with tools to measure and monitor social and emotional skills that lead to academic success. Retrieved from: https://www.childtrends.org

[34] Valiente, C., Doane, L. D., Clifford, S., Grimm, K. J., & Lemery-Chalfant, K. (2021). School readiness and achievement in early elementary school: Moderation by students' temperament. *Journal of Applied Developmental Psychology, 74*. https://doi.org/10.1016/j.appdev.2021.101265

[35] Hall, K., Sambu, W., Almeleh, C., Mabaso, K., Giese, S. & Proudlock, P. (2019). *South African Early Childhood Review 2019*. Cape Town: Children's Institute, University of Cape Town and Ilifa Labantwana. https://ilifalabantwana.co.za/wp-content/uploads/2019/09/SA-ECR_2019_12_09_2019_online_pages.pdf>

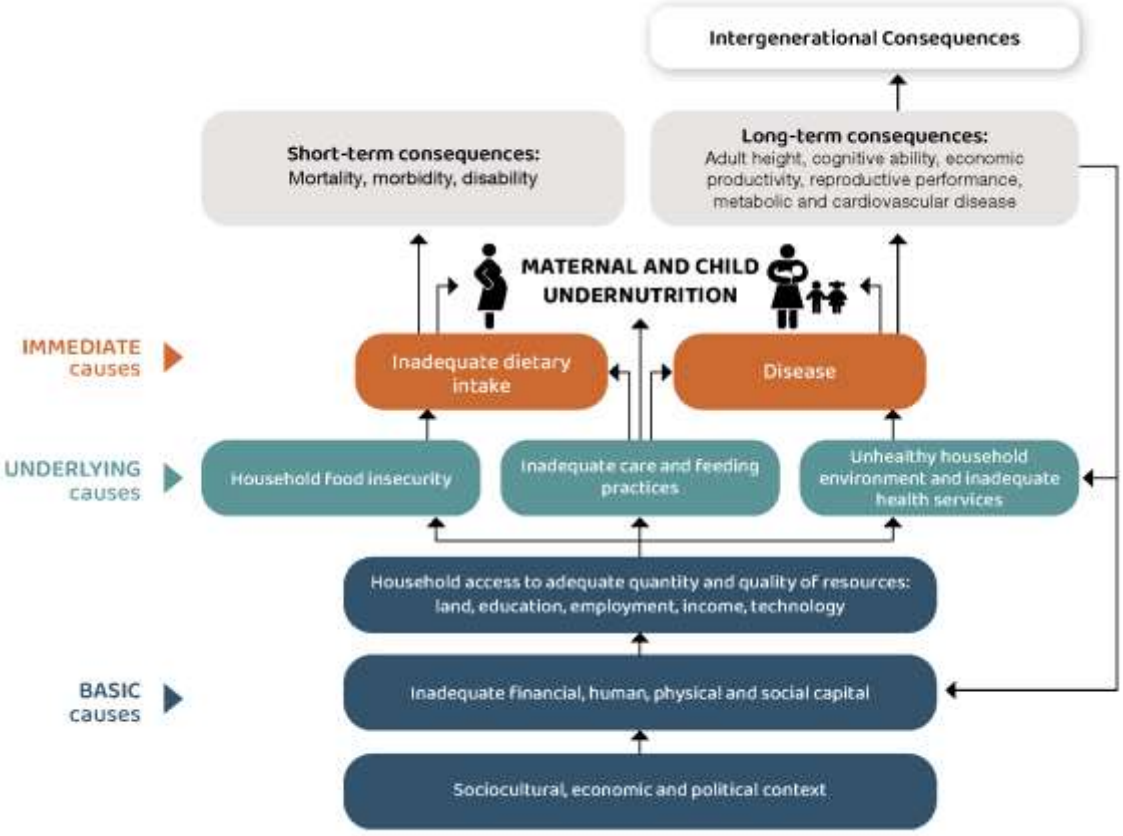


Figure 3: UNICEF framework for determinants of child undernutrition[36] [37]

As Benny and colleagues note (p. 16):

> "…even before conception or during pregnancy, maternal undernutrition, exposure to toxins, chronic stress, alcohol and drug intake, or conditions such as HIV, can damage foetal development, resulting in stunting during infancy that may persist throughout life, also affecting subsequent generations. Such early disadvantages may be compounded by undernutrition and recurrent infections in early childhood, growth being especially susceptible to disturbances in the first 1,000 days of life starting at conception".

The effects of early stunting depend on the child's age and the duration of deprivation, but can persist throughout childhood and adolescence, compromising the child's ability to learn in school and eventually impacting on their life opportunities. In the Young Lives longitudinal study of the development of children growing up in poverty in four low- and middle-income

[36] Source: United Nations International Children's Fund. *Multi-sectoral Approaches to Nutrition: Nutrition-specific and Nutrition-sensitive Interventions to Accelerate Progress*. New York: UNICEF; 2014. The dark black arrows show that the consequences of undernutrition can feed back to the underlying and basic causes of undernutrition, perpetuating the cycle of undernutrition, poverty and inequities (Source: Benny, Boyden & Penny, 2018).

[37] Benny, L., Boyden, J., &, Penny, M. (2018) Early is best but it's not always too late: Evidence on nutrition and growth from the Young Lives study in Ethiopia, India, Peru and Vietnam, Summative Report. Oxford: Young Lives. https://assets.publishing.service.gov.uk/media/5b9a8b6040f0b6788dda2bc5/Nutrition_and_Growth_Summative_Report_June_2018_0.pdf

countries,[38] children who were stunted at 12 months were more likely to remain stunted and cognitively compromised throughout childhood and adolescence. Boys were more at risk than girls.

However, stunting and its effects in the early years are not necessarily irreversible. Evidence of recovery in a proportion of children prior to age 5 (and beyond) has been forthcoming from longitudinal studies. For example, in the Indian Young Lives cohort, the stunting rate at 12 months was 33% but at 60 months only 21% of those children remained stunted. Across the four countries in the Young Lives study, the risk of stunting was greater for boys than girls across childhood.

In South African studies, both the National Income Dynamics Study (NIDS) and the Birth to Twenty Cohort study findings provide evidence of substantial catch-up growth (Casale, 2016; Desmond & Casale, 2017; Casale 2019)[39]. However, catch -up does not necessarily translate into enduring cognitive gains. Casale and Desmond (2016) report that Birth to Twenty children who recovered from stunting between 2 and 5 years still did worse than their non-stunted counterparts on cognitive tests at 5 years, and almost as badly as children who remained stunted. Most policy-related research on child growth focuses on the implications for development of moderate and severe growth stunting. But as Stevens et al. (2012, p.824)[40] point out, "the hazardous effects of undernutrition happen along a continuum of mild, moderate, and severe undernutrition." The implication is that mild stunting (HFAZ below 1 Standard deviation of the median of the WHO reference population) should not be ignored as it could be a barrier to thriving.

The findings suggest a dynamic age and resource-related process. The drivers of recovery are not well understood but Young Lives findings "indicate that growth after early childhood is responsive to positive changes in the household and community environments and that growth promotion after early childhood may yield improvements in child cognitive development" (Georgiadis et al., 2017, p. 81).[41] Where improvements in household wealth, services (sanitation and water) and nutrition were sustained from the early years, growth recovery was also more likely to be maintained.

2. Similarities and differences between boys and girls in cognitive skills by age 5

There has long been considerable interest in sex differences in cognitive skills (particularly in mathematics and language). The findings are mixed for many reasons, not least due to the variety of measures used. The first comprehensive evaluation of the

[38] https://www.younglives.org.uk

[39] Casale, D. and Desmond, C. (2016) Recovery from stunting and cognitive outcomes in young children: evidence from the South African Birth to Twenty Cohort Study. Journal of Developmental Origins of Health and Disease 7: 163-171. Casale, D. (2016). Analysing the links between child health and education outcomes: Evidence from NIDS Waves 1-4. Cape Town: SALDRU, University of Cape Town. SALDRU Working Paper Number 179/ NIDS Discussion Paper 2016/6. Casale, D. (2019). Recovery from stunting in early childhood and subsequent schooling outcomes: Evidence from NIDS Waves 1-5. Cape Town: SALDRU, UCT. (SALDRU Working Paper Number 236, Version 1/ NIDS Discussion Paper 2019/3).

[40] Stevens, G. A., Finucane, M. M., Paciorek, C. J., Flaxman, S. R., White, R. A., Donner, A. J., Ezzati, M., Nutrition Impact Model Study Group. (2012). Trends in mild, moderate, and severe stunting and underweight, and progress towards MDG 1 in 141 developing countries: a systematic analysis of population representative data. The lancet, 380(9844), 824-834. https://doi.org/10.1016/S0140-6736(12)60647-3

[41] Georgiadis, A., Benny, L., Duc, LT., Galab, S., Reddy, P., & Woldehanna, T. (2017) Growth recovery and faltering through early adolescence in low- and middle-income countries: Determinants and implications for cognitive development. *Social Science & Medicine, 179*, 81-90.

research was conducted by Maccoby and Jacklin (1974).[42] Research from middle- and high-income countries has predominated – particularly the USA and the UK. We only provide a brief high-level overview of recent knowledge of similarities and differences in the areas of interest to this study.

In the most recent analysis of longitudinal study data using measures comparable to the ELOM 4&5, Toivainen et al. (2017)[43] report findings from 16 000 twin pairs on both non-verbal and verbal abilities, measured from early childhood (ages 2, 3 and 4 years) through adolescence to age 16. Non-verbal ability was assessed using parents' reports on a standardised test (the PARCA), measuring number, shape, size, conceptual grouping and orientation skills. Verbal abilities were assessed on expressive vocabulary and grammar tests, based on the MacArthur Communicative Development Inventories.

In that large sample study, females outperformed males on both verbal and non-verbal tasks prior to age 5 years.

The larger research literature on this issue can be summarised in the following broad strokes:

- Evidence from studies conducted in the early childhood period (pre-Grade R) can be summarised as showing that girls outperform boys on tests of both language and mathematics as early as 24 months (although the differences are small at that point). Girls retain the advantage in language skills – particularly writing, and language use through school – and the gap widens with age. Boys tend to get ahead of girls in mathematics skills from around Grade 4 (Bornstein et al., 2004;[44] Halpern et al., 2007[45]), although this is not reported in all studies, and it does appear to depend on the measures used by the researchers (Toivainen et al., 2017).
- It is probable that the observed early childhood sex differences are due to more rapid brain development in girls. The twin studies in particular suggest that socialisation during this period, while influential, makes a limited contribution to sex differences in *cognitive* skills such as mathematics and language.

It is important to stress that all human development is a product of the ongoing interaction of heritable characteristics (Plomin, 2018[46]), socialisation and the learning resources to which the child is exposed. All contribute to differences in the early and later cognitive and language skills of boys and girls. It is not a matter of which one source is responsible for a particular outcome (e.g., reading ability), but rather how different sources of influence interact and combine under particular conditions and during particular points in maturation.

[42] Maccoby, E. E., & Jacklin, C. N., 1974. *The Psychology of Sex Differences*. Stanford University Press, Stanford.

[43] Toivainen, T., Papageorgiou, K. A., Tosto, M. G., & Kovas, Y. (2017). Sex differences in non-verbal and verbal abilities in childhood and adolescence. *Intelligence*, *64*, 81-88. http://dx.doi.org/10.1016/j.intell.2017.07.007

[44] Bornstein, M. H., Hahn, C.-S., & Haynes, O. M. (2004). Specific and general language performance across early childhood: Stability and gender considerations. *First Language*, 24(3), 267-304.

[45] Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest*, *8*(1), 1-51.

[46] Plomin, R. (2018). *Blueprint: How DNA makes us who we are*. London: Allen Lane, Penguin Random House.

3. Index rationale and measures

3.1. Why the Index?

For both policy and intervention purposes, there is a need for data that can be used to longitudinally monitor the quality of ELP provision and Early Learning outcomes in children in the age band 50-59 months, and to track health and Social-Emotional Functioning. *Thrive by Five Index 2021* constitutes the first (baseline) in a series of nationally and provincially representative surveys that will monitor trends over time in the proportions of children 50-59 months who are *On Track* for their age in key areas of development.

The term *On Track* is understood to mean meeting the expected standards for age in each of the domains.

Data for the Index was collected between September and November 2021 by a team of trained assessors managed by ikapadata (see accompanying *Thrive by Five Index 2021 Fieldwork Report).* Data was collected prior to the ECD function shift from the DSD to the DBE. The findings can be used to support future efforts to ensure that more children receive the nurturing care and services they need to help ensure their development is *On Track,* and to strengthen collective efforts to support those who are not. In addition, the Index will permit monitoring of the country's progress towards attainment of SDG Target 4.2:

"*By 2030, all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education."*

The relevant SDG indicator is: 4.2.1: *The proportion of children under 5 years of age who are developmentally on track in health, learning and psychosocial well-being, by sex.*

Table 6: Indicators used in the Thrive by Five Index

Indicator	Measure and definition
Learning	Measure: Early Learning Outcomes Measure 4&5 Years Assessment tool (ELOM 4&5)
Children's learning is *On Track*	Definition: Total and Domain scores[47] on the ELOM 4&5 fall at or above the 60th percentile of the ELOM 4&5 standard score distribution, established in 2016
Children's learning is *Falling Behind*	Definition: Total and Domain scores on the ELOM 4&5 fall between the 32nd and 59th percentile
Children's learning is *Falling Far Behind*	Definition: Total and Domain scores on the ELOM 4&5 fall below the 32nd percentile

[47] The ELOM 4&5 has 23 items clustered in five domains: Gross Motor Development; Fine Motor Coordination and Visual Motor Integration; Emergent Numeracy and Mathematics; Cognition and Executive Functioning; and Emergent Literacy and Language.

Social and Emotional Functioning	Measure: ELOM Social-Emotional Rating Scale (Teacher Assessment of children's social and emotional functioning)
Children's Social Relations are *On Track*	Definition: The Total Score on the ELOM 4&5 Teacher Assessment *Social Relations with Peers and Adults* scale ε18
Children's Social Relations are not *On Track*	Definition: The Total Score on the ELOM 4&5 Teacher Assessment *Social Relations with Peers and Adults* scale < 18
Children's Emotional Readiness for School is *On Track*	Definition: The Total Score on the ELOM 4&5 Teacher Assessment *Emotional Readiness for School Scal*e ε 9
Children's Emotional Readiness for School is not *On Track*	Definition: The Total Score on the ELOM 4&5 Teacher Assessment *Emotional Readiness for School Scal*e < 9
Physical Growth	Measure: Height was measured using a stadiometer
Normal Growth	Definition: The child's (HFAZ) falls between -2 and +2 SDs of the WHO reference group median
Stunted Growth	Definition: The child's HFAZ > 2 SDs <u>below</u> the WHO reference group median. We consider mild stunting (HFAZ > 1SD below median) in the modelling of Total ELOM 4&5 later in the report, but do not report it in the descriptive sections.
Severely Stunted Growth	Definition: The child's HFAZ > 3 SDs <u>below</u> the WHO reference group median

*Note: For regression analyses and some descriptions, the *Social Relations with Peers and Adults* and *Emotional Readiness for School* scales are combined into one measure of "*Social-Emotional Functioning*"

3.2. Thrive by Five Questions

The Index sought to provide data to answer these key questions for the country as a whole and for each province:

1. For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (achieving the expected developmental standard), *Falling Behind* the standard and *Falling Far Behind* the standard?
2. For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track*, *Falling Behind* and *Falling Far Behind* the standard?
3. For the social-emotional domains, what proportion of children meet the expected score for their Social Relations with Peers and Adults, and their Emotional Readiness for School?
4. What proportion of children show normal growth, or are stunted or severely stunted in their growth?

Supplementary questions that we addressed include:

5. What is the relationship between children's growth status and their performance on the ELOM 4&5?
6. What is the relationship between children's social and emotional status and their performance on the ELOM 4&5?

7. What is the relationship between performance on the ELOM 4&5 and the years a child has been enrolled in the programme, and their average attendance per week in the term preceding data collection?

3.3. Thrive by Five Measures

The measures described below were used to assess children and to derive findings for the Index. All children were assessed in their home languages. Assessors received thorough training in the use of the tools and quality was monitored in the field. For comprehensive information on all data collected and procedures used in the Thrive by Five Index, see the related ikapadata *Fieldwork Report*.

3.3.1. Early Learning Outcomes

Children's learning outcomes were directly assessed using the ELOM 4 & 5 Years Assessment (ELOM 4&5). The instrument is aligned with the South African Early Learning curriculum and was developed and standardised for use with children aged 50-69 months. It provides a reliable and fair assessment of children regardless of their socio-economic and ethnolinguistic background, and is available in all the official languages of South Africa. Content, construct, age and concurrent validity (with the WPSSI-IV), as well as test-retest reliability, have been established (Dawes et al., 2020; Anderson et al., 2021;[48] Snelling et al., 2019.[49]) The predictive validity of ELOM 4&5 for early academic achievement has not been assessed.

The ELOM 4&5 has 23 items clustered in five domains:

1. Gross Motor Development (GMD);
2. Fine Motor Coordination and Visual Motor Integration (FMC-VMI);
3. Early Numeracy and Mathematics (ENM);
4. Cognition and Executive Functioning (CEF); and
5. Emergent Literacy and Language (ELL).

A child's performance on each item in each of the five ELOM 4&5 domains is awarded a raw score, which is then transformed into a scaled score. In each domain, item standard scores are summed to provide a domain Total Score out of 20. The five domain scores are then summed to derive the ELOM 4&5 Total Score out of 100. Further information is available in the *Early Learning Outcomes Measure (ELOM) Technical Manual*.

[48] Anderson, K. J., Henning, T. J., Moonsamy, J. R., Scott, M., Du Plooy, C., & Dawes, A.R.L (2021), Test–retest reliability and concurrent validity of the South African Early Learning Outcomes Measure (ELOM). *South African Journal of Childhood Education*, 11(1), a881.

[49] Snelling, M., Dawes, A., Biersteker, L., Girdwood, E., & Tredoux, C. (2019). The development of a South African Early Learning Outcomes Measure: A South African instrument for measuring early learning program outcomes. *Child: Care, Health and Development, 45*, 257–270. https://doi.org/10.1111/cch.12641

As illustrated in Table 7, three performance bands have been empirically derived from the ELOM 4&5 Total Score distribution (Dawes et al., 2020):[50]

- *On Track: Achieving the ELOM 4&5 Standard* for learning outcomes for their age group (50-59 months) (child's score falls within the green band in Table 7);
- *Falling Behind* the standard (child's score falls within the yellow band in Table 7); and
- *Falling Far Behind* the standard (child's score falls within the red band in Table 7).

Table 7: ELOM 4&5 performance bands and score ranges for children aged 50-59 months

	50 – 59 months		
	*Falling Far Behind**	*Falling Behind*	*On Track*: Achieving the Standard
ELOM TOTAL	0 – 36.01	36.02 – 46.31	46.32 – 100
GMD	0 – 5.40	5.41 – 8.59	8.60 – 20
FMC-VMI	0 – 9.70	9.71 – 12.31	12.32 – 20
ENM	0 – 6.34	6.35 – 9.32	9.33 – 20
CEF	0 – 4.07	4.08 – 7.16	7.17 – 20
ELL	0 – 6.53	6.54 – 10.25	10.26 – 20

* Note: In the *Early Learning Outcomes Measure (ELOM) Technical Manual*, *Falling Far Behind* is called *At Risk*. The name has been changed for purposes of clarity and to indicate a gradient of performance.

[50] Dawes, A., Biersteker, L., Girdwood, E., Snelling, M.J.T.L., Tredoux, C.G. et al. (2020). *Early Learning Outcomes Measure (ELOM) Technical Manual.* Claremont, Cape Town: The Innovation Edge. http://ELOM.org.za/wp-content/uploads/2020/06/ELOM-Technical-Manual_2020.pdf

3.3.2. Social and emotional functioning

Children's social and emotional functioning is associated with their school readiness (Arnold et al., 2012,[51] Collie et al., 2019[52], Denham et al., 2012).[53] Using the ELOM 4&5 scales of social and emotional functioning, each child is rated by their teacher on three brief scales designed to assess their self-care (ability to self-toilet and the quality of their emotional functioning in areas relevant for managing the school environment. The reliability and concurrent validity of the latter two scales were established on a sample of 261 children using the Strengths and Difficulties Questionnaire for comparative purposes. Normative standards have not been derived for these scales. However, expected scores indicating the child's physical maturity and emotional and social readiness for school have been derived for the two scales used in this report. The method used is reported in Dawes et al. (2020):

- Social Relations with Peers and Adults scale: A score of 18 and above
- Emotional Readiness for School scale: A score of 9 and above

While these are reliable and valid scales, unlike other measures used in the study, they are based on teacher reports. The reliability of a teacher's ratings will depend on how well he or she knows a child. Also, it is probable that teachers will rate children higher who are compliant, cooperative, well controlled and more proficient in daily tasks (a halo effect). Despite these limitations, the scales provide a brief, but coarse, indication of a child's social and emotional wellbeing. They do not measure behavioural or emotional disorders.

For regression analyses, scores on the two scales are combined to form a measure of Social-Emotional Functioning.

3.3.3.Growth status

Growth status is measured as the child's HFAZ (WHO Multicentre Growth Reference Study Group, 2006). HFA was measured using a stadiometer.

3.4. Thrive by Five Composite Indicator

The Thrive by Five Composite Indicator was constructed for use at national level. It comprises two equally weighted indicators: stunting (including moderate and severe stunting) and ELOM 4&5 Total Score. These were chosen as they are both based on

[51] Arnold, D. H., Kupersmidt, J. B., Voegler-Lee, M. E., & Marshall, N. (2012). The association between preschool children's social functioning and their emergent academic skills. *Early Childhood Research Quarterly*, 27(3), 376-386. https://doi.org/10.1016/j.ecresq.2011.12.009

[52] Collie, R. J., Martin, A. J., Nassar, N., & Roberts, C. L. (2019). Social and emotional behavioral profiles in kindergarten: A population-based latent profile analysis of links to socio-educational characteristics and later achievement. *Journal of Educational Psychology, 111*(1), 170-187. http//dx.doi.org/10.1037/edu0000262

[53] Denham, S. A., Bassett, H. H., Mincic, M., Kalb, S., Way, E., Wyatt, T., & Segal, Y. (2012). Social-emotional learning profiles of preschoolers' early school success: A person-centered approach. *Learning and Individual Differences, 22,* 178–189. http://dx.doi.org/10.1016/j.lindif.2011.05.001

Collie, R. J., Martin, A. J., Nassar, N., & Roberts, C. L. (2019). Social and emotional behavioral profiles in kindergarten: A population-based latent profile analysis of links to socio-educational characteristics and later achievement. *Journal of Educational Psychology*, *111*(1), 170-187. http//dx.doi.org/10.1037/edu0000262

objective standardised measures and both are crucial for monitoring children's health and development prior to entering the Foundation Phase of school.

The Composite Indicator describes the proportions of children who fall into one of the following three categories: Children who are thriving (*On Track* in both growth and learning), children who face barriers to thriving (*On Track* for only one of either growth or learning) and children who face significant barriers to thriving (not *On Track* for both growth and learning).

Method

A detailed report on the sampling and fieldwork for the Thrive by Five Index accompanies this report. Summary information drawn from that document is included here.

1. Sampling

The sample consisted of a representative sample of children aged 50-59 months *enrolled in various types of ELPs*. The sampling frame excluded mobile centres (problematic for geo-sampling) and pure toy libraries.

While the sample can provide a sound picture of children attending services, it cannot be regarded as reliably representative of all children in this age group for two primary reasons: a) no official enumerated list of ELPs is available and some services attended by children may not have been included in the sampling frame, and b) many children in this age group, particularly from lower income backgrounds, do not attend an ELP. In 2016, 69% of 3- to 5-year-olds participated in some form of programme prior to Grade R (Statistics South Africa, 2018). However, children in the wealthiest 20% of the population were twice as likely to be enrolled as the poorest 20% (Hall et al., 2019).[54]

A multistage cluster sampling strategy was employed to recruit the sample and to permit disaggregation of findings by sex, province and income quintile. The key outcome measures were a) performance on the ELOM 4&5 instrument (Total Score, and the five subdomains), allowing us to determine the proportion of children who are *On Track* for Early Learning outcomes, b) social and emotional functioning, and c) HFA growth status.

- In the first stage, 48 public and private primary or combined[55] schools per province were randomly selected, stratified by the quintile rank (1-5)[56] assigned by the DBE (432 schools nationally). In the absence of household level data, quintiles were used as proxies for the probable socio-economic background of the children who were assessed. It is recognised that school quintiles are limited and that they cannot necessarily be regarded as reflecting the same socio-economic level in different provinces, as they depend on provincial income distributions (which may differ).[57] Also, while the school may be in a quintile 4 area based on the characteristics of that population, the intake may comprise significant numbers of poor children whose primary caregivers aspire to the better quality of education they perceive

[54] Statistics South Africa. (2018). Education Series Volume IV: *Early childhood development in South Africa, 2016*. http://www.statssa.gov.za/publications/92-01-04/92-01-042016.pdf
Hall, K., Sambu, W., Almeleh, C., Mabaso, K., Giese, S., & Proudlock, P. (2019). *South African Early Childhood Review 2019*. Children's Institute, Ilifa Labantwana, Department of Planning, Monitoring and Evaluation in the Presidency, The Grow Great Campaign, Innovation Edge. https://ilifalabantwana.co.za

[55] Combined schools in this case refer to schools that include the primary phase as well as later phases. These are often smaller schools in rural or farm areas.

[56] Data on the relative poverty levels of the community living within 3km of a public school are used by Provincial Departments of Basic Education to assign a quintile rank (1 = poorest, 5 = wealthiest) to each school. Ranks are based on the income, education level and unemployment of households in the school catchment area. The Norms and Standards for School Funding are used to allocate funds and regulate fees for the different quintiles. (Quintile 1-3 schools, which are located in the poorer communities, may not charge fees.)

[57] Mestry, R., & Ndhlovu, R. (2014). The implications of the National Norms and Standards for School Funding policy on equity in South African public schools. *South African Journal of Education*, *34*(3), 1-11.

to be provided at these schools.[58] These are recognised limitations of the quintile system but we believe this was the best option available. Specifically, we used the variable *quintile_original* in the dataset as our preferred indication of quintile, since this is the quintile rank used for developing the weights. We checked the reasonableness of the proposition that school quintiles reflect socio-economic status by comparing school quintile rankings with whether the ELP received a subsidy from the DSD (DSD subsidies are targeted at ELPs serving low-income communities), and by computing the mean (and SD) scores for average school fees charged (based on interviews with 545 principals in the baseline assessment questionnaire), per quintile. These are reflected in Table 8 below.

Table 8: School quintiles correspond to other, approximate measures of socio-economic status

School quintile	% receiving subsidy	Mean (and SE*) fees charged
1	75%	R210 (R55.3)
2	65%	R196 (R25.3)
3	71%	R235 (R26.9)
4	56%	R379 (R70.1)
5	27%	R1 131 (R276)

* SE = standard error (throughout the report)

- In stage two, since there is no official enumerated list of ELPs in South Africa, we used a multi pronged strategy to build a sampling frame of suitable ELPs. We made use of the Vangasali[59] dataset of ELPs to identify all ELPs in the same ward as the sampled schools and, where necessary, contacted sampled schools and known ELPs within each ward to identify additional ELPs. ELPs were considered eligible if they (1) operated for more than eight hours per week, and (2) had at least six children aged 50 to 59 months (4 years old) in regular attendance who spoke at least one of the official South African languages as their home language. It was originally intended to randomly sample four ELPs within a 10km radius or in the same ward as the schools identified in Stage 1. However, there were often fewer than four eligible ELPs that fulfilled those criteria, in which case the next closest ELPs that did satisfy the criteria were added to the sample. In some cases, these ELPs were in fact closer to other schools in the sample, closer to schools outside the sample, or in wards different from those of the sampled school associated with that cluster of ELPs. Each ELP was called up to five times before they were dropped from the list as being permanently out of reach. Three ELPs in each of the clusters were randomly selected, resulting in a sample of roughly 144 ELPs per province, and 1,250 nationwide.

[58] Van Dyk, H., & White, C. J. (2019). Theory and practice of the quintile ranking of schools in South Africa: A financial management perspective. *South African Journal of Education, 39*, S1-S9.

[59] Vangasali is a Government campaign launched in 2020 with the aim of identifying all Early Childhood Development programmes (including ECD centres, playgroups, toy libraries, day mothers) in the country.

- In the final stage of sampling, the intention was for four children (two boys and two girls) in each ELP to be randomly selected for assessment. The target was 12 children per school cluster, intended to result in a nationally representative sample of 5,184 children nationwide, 576 per province.

Details on the final sample are included in Table 9 below.

2. Weighting

Sampling weights were constructed by first determining a stratification weight for province and quintile (based on the number of primary schools sampled relative to the total number of primary schools in Province-Quintile combinations). This weight was multiplied by a second weight that was constructed as a relative weight for each centre sampled in an ECD programme cluster multiplied by the estimated population size of the cluster sampled in the data collection phase. Population size of cluster was estimated by proxy from the number of Grade 3 enrolments in the closest primary or combined school. A comprehensive account of the construction of sampling weights is given in the Appendices. Weighting was also applied for analyses undertaken by Van der Berg and Bridgman when extrapolating the findings to the 50-59-month population as a whole. This is provided in a separate report.

3. Procedure

For details on the administration of the ELOM 4&5 and the collection of data regarding height/growth status, and Social and Emotional Functioning, the reader is referred to the accompanying ikapadata *Fieldwork Report*.

4. Final sample for analysis

Ikapadata conducted initial data cleaning and labelling and provided a dataset for analysis in December 2021 ("thrive_ELOM_anon.dta"). The dataset contained 5,570 cases, sampled from 432 clusters. Of these, 5,222 were flagged as "valid" by ikapadata, and 348 as "invalid" during data cleaning. (See the metadata file provided by ikapadata, attached to this report.) Invalid cases included duplicates and dummy assessments as well as assessments with children who fell outside the eligibility criteria. The ikapadata team also flagged several records collected by a fieldwork team in Mpumalanga, using an incorrect version of ELOM 4&5 Item 23[60] (see below). We did not invalidate these 88 cases in the "valid case" sample (see explanation in the next section). Once sampling weights were constructed by Dr Taylor, Ms Bridgman and team, the sample was further reduced to 5,139 cases (missing information meant that additional cases had to be dropped from analyses involving weights).

The final sample numbers, disaggregated by sex and quintile, are shown for each province in Table 9. A three-way breakdown is reported in the Appendices. The sample sites are also shown as a layer on a map of South Africa.

The resultant child sample consists of a representative selection of children aged 50-59 months who were enrolled in ELPs.

[60] See the ikapadata Thrive by Five Fieldwork Report (pp. 19-20)

Table 9: Study sample: breakdown by province, quintile and sex

Income Quintile	Eastern Cape N = 587	Free State N = 576	Gauteng N = 571	KwaZulu-Natal N = 575	Limpopo N = 578	Mpuma-langa N = 588	North West N = 588	Northern Cape N = 600	Western Cape N = 559	National
1	219 (37%)	244 (42%)	62 (11%)	242 (42%)	225 (39%)	180 (31%)	240 (41%)	206 (34%)	121 (22%)	1,739 (33%)
2	184 (31%)	113 (20%)	72 (13%)	126 (22%)	247 (43%)	154 (26%)	107 (18%)	152 (25%)	106 (19%)	1,261 (24%)
3	160 (27%)	132 (23%)	164 (29%)	128 (22%)	94 (16%)	116 (20%)	211 (36%)	92 (15%)	77 (14%)	1,174 (22%)
4	11 (1.9%)	37 (6.4%)	122 (21%)	43 (7.5%)	0 (0%)	80 (14%)	30 (5.1%)	68 (11%)	104 (19%)	495 (9.5%)
5	13 (2.2%)	50 (8.7%)	151 (26%)	36 (6.3%)	12 (2.1%)	58 (9.9%)	0 (0%)	82 (14%)	151 (27%)	553 (11%)
Sex	EC	FS	GAU	KZN	LIM	MPU	NW	NC	WC	National
Male	284 (48%)	278 (48%)	278 (49%)	278 (48%)	295 (51%)	284 (48%)	285 (48%)	275 (46%)	268 (48%)	2,525 (48%)
Female	303 (52%)	298 (52%)	293 (51%)	297 (52%)	283 (49%)	304 (52%)	303 (52%)	325 (54%)	291 (52%)	2,697 (52%)

Note: The numbers in this table are computed on the unweighted sample, N = 5222. The numbers may not match other totals in the report, due to missing data on some variables.

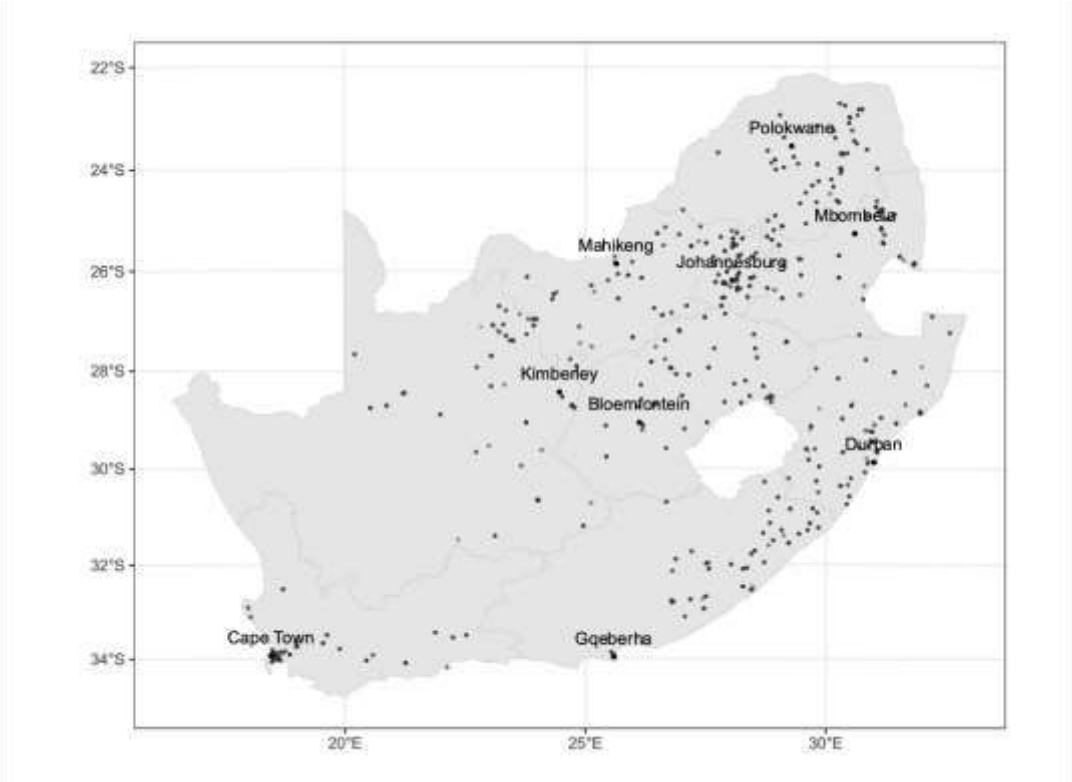


Figure 4: *Sample sites (black dots) for Thrive by Five Index 2021*

5. Missing data and possible data quality problems

As indicated above, we followed ikapadata's recommendation to analyse only cases that had been flagged as "valid" (except for the note regarding ELOM 4&5 Item 23 above). It is useful to note that ikapadata flagged the following issues in its report, and in its metadata:

Teacher ratings of the child's Social Relations with Peers and Adults and their Emotional Readiness for School were not obtainable for 442 children (373 of the valid cases), as the practitioner (who is supposed to complete the ratings) was not present when data was collected.

The ikapadata *Fieldwork Report* (pp. 19-20) refers to an error in the isiZulu version of one of five ELL domain items – 23 (Initial Sound Discrimination) that affected 176 cases. These were identified when imported from the ikapadata file.

For Item 23, in the practice and each of the three trials, the assessor says "*I will say three words and you will tell me which one starts with* (the initial sound of the word to be identified by the child – e.g., '*D*'). In the English version of Trial 1, the instruction is as follows: *"I will say three words and you will tell me which one starts with 'D'. BALL DOOR COW."* The correct response is *DOOR*.

In the erroneous form used early in the fieldwork by the Mpumalanga Emalahleni District Municipality team:

- The assessor instruction for the *Practice Trial* was *repeated* in *Trial 1* (of 3). This meant that these children had already been exposed to the content of this trial in the practice round and there was liable to be a practice effect resulting in a correct response and upward bias in their domain scores.

- The list of stimulus words provided by the assessor to the child in both the Practice and Trial 1 of the incorrect isiZulu form was different from that in the version that should have been used. However, the word the child needed to identify for a correct response to the assessor's question (*Ngizosho amagama amathathu bese wena ungitshela ukuthi yiliphi eliqala ngo-'D'*?) commenced with the *same initial sound* (*'D') as that in the correct version* of Trial 1.

We considered computing the score for the 5th ELOM 4&5 domain (ELL) from the remaining two items. However, this could have resulted in scores that would not be comparable over time (one of the main aims of the Thrive by Five Index exercise). As the correct response was the same as expected for the correct isiZulu version, *we decided to retain the scores of these cases in our dataset*. Discarding them would have had significant implications, reducing the total sample for Mpumalanga to 504 cases (72 below the provincial sample target of 576).

As a result of this choice, we considered the possibility of a limited upward bias in the Mpumalanga ELL domain and on the Total ELOM 4&5 Score for the province as a consequence of practice effects noted above. To assess this, we computed the Mpumalanga scores including and excluding the problematic item. The observed differences are very small, and we do not think that the results are substantively affected. Further information on this computation is included in the Appendices.

Of the remaining cases that were considered invalid, it was clear that some data was missing. This was pronounced for the variables assessing children's *Emotional Readiness for School* and their *Social Relations with Peers and Adults* (373 cases, as discussed above). There were also seven missing cases for the variable recording *child's WHO Z-transformed height*, and for the stunting category variable dependent on it.

Table 10: Missing cases, per province and variable

Province	Social and emotional readiness N missing	Sample weights N missing	Height N missing	TOTAL
Eastern Cape	74			74
Free State	17	11	1	29
Gauteng	74		3	77
KwaZulu-Natal	21			21
Limpopo	2		1	3
Mpumalanga	3	48		51
North West	6	24	1	31
Northern Cape	163		1	164
Western Cape	13			13
TOTAL	373	83	7	463

Note: Final column reflects total missing per province; some cases have missing data on more than one category. The tabulation shown above is based on the sample of 5,222 cases, prior to computing the weighting variable.

The variables reflecting the ELOM 4&5 total and domain scores seemed intact, without any missing data. (Although the component items sometimes appeared to have missing data, these may be optional items, or items administered after successfully answering earlier items, but our attention was not brought to any issues regarding their completeness.)

Inspection of the pattern of missing values suggested the following patterns. For variables measuring Social and Emotional Functioning (SEF), the Northern Cape, Gauteng and Eastern Cape had 80% of the missing cases, and one may need to be cautious about considering the results reported later to be representative of SEF in those provinces. For the variable measuring height (and therefore healthy growth), the seven missing data points were spread over five provinces and are so few as to suggest little biasing effect on analyses involving height.

We considered imputation of missing data but did not think that the reason for missing data in the case of the teacher ratings of SEF could reasonably be considered missing at random (it shows clear variation across provinces, for a start), and nor could the missing data for school quintile. The missing data for height (seven cases) could perhaps satisfy this assumption, but since there were so few missing cases, excluding them in analyses would be very unlikely to bias results tangibly.

We considered variation of scores between fieldwork teams, within quintiles, as a possible indication of quality of data collection. The figure below charts the difference between fieldwork teams, and there are some notable differences: between teams 5 and 6 in Mpumalanga, 11 and 12 in the Northern Cape and team 9 and the other three teams in Gauteng for quintile 2. However, there may be good reasons for differences across fieldwork teams (e.g., assignment to different geographic regions, even if of the same quintile), and the differences shown in the figure below might not reflect quality differences.

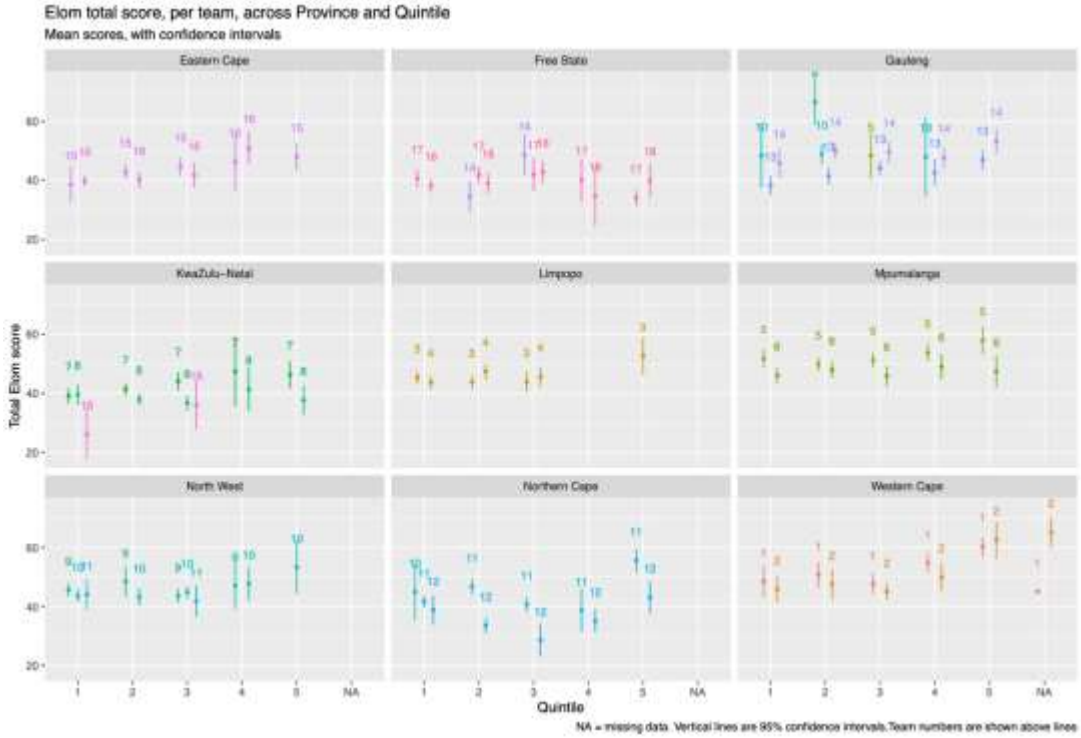


Figure 5: *Variation between rating teams within provinces*

(Note: provinces were defined for this particular analysis on the basis of the national Education Management Information System records)

Another data matter worth noting is regarding the correct variable to use for classifying an ELP's quintile status. The quintile rank system is specific to *schools* in South Africa and ELPs are not officially classified in a similar way. The quintile rank system is a valuable proxy for the wealth status of the children assessed and was used for stratification during the sampling process, as well as for disaggregation in the analysis. There are three approaches that can be used in assigning a quintile status to an ELP:

- Using the quintile status of the primary school that was used when constructing the sample (quintile_original);
- Using the quintile status of the closest primary school in the school sample used to identify clusters (quintile_sample); or
- Using the quintile status of the closest school in the DBE 2021 Masterlist data (quintile_natemis).

The research team decided to use the quintile status of the primary schools that was used to construct the sample (quintile_original) for both the construction of the weights, as well as for disaggregation. For the construction of weights, the quintile_original variable is most appropriate because it determined the probability of an ELP having been sampled. For disaggregation, the variable quintile_original was deemed the most conservative choice of classification to use, since it will not introduce any additional measurement error that cannot be accounted for (for example, the closest school being in a typical quintile 5 area, while the ELP is in a neighbouring Q3 area)[61].

[61] Note that in the modelling of Elom total scores reported later in the report we use quintile_natemis instead of quintile_original. Our investigations prior to the constructions of sample weights led us to conclude that this quintile variable is best for modelling purposes, and since the modelling does not use weighted data, we kept it for the modelling in preference.

Findings

1. Introduction

It is most important to recognise that the data used in these analyses was collected between September and November 2021. The Covid-19 pandemic significantly affected the ECD service sector over the two-year period preceding this data collection. Closures of ELPs during various lockdown periods in 2020 and 2021 significantly disrupted the amount of programme participation possible for the cohort of children of interest here. In addition, crèches and preschools were subject to standard operating procedures required by the DSD to manage risks of infection.

The impact of the pandemic and associated changes to the daily programmes of ELPs have likely changed the nature of children's experience in several ways and in all probability reduced the amount of benefit they might normally have gained. In addition, for all children, but particularly those in the lower three school quintiles, the impact of the pandemic on livelihoods, household resources and caregiver wellbeing has likely impacted on their nutritional intake, health and development.

As a result, one cannot regard the findings that follow as reflecting children's development under normal societal conditions. However, as we do not have representative data on the pre-pandemic population of children under 5 years of age, we cannot say the extent to which these findings represent a "Covid-19" effect. That judgement must await comparison with future survey rounds.

Findings are reported for each of our study questions at national level and then for each province. Unless indicated, these are stratified by sex and, in the case of the national samples, the primary school quintile along which it was stratified.[62] We do not report provincial level ELOM 4&5 scores by quintile, as there are too few cases in some quintiles in certain provinces, and scores would therefore be imprecise.

As noted in the Method section of this report, the sample was weighted to take account of variations in the child populations in each school quintile, and in each province, and using the Grade 3 enrolment in each school to estimate the population size corresponding to the clusters of ELP sites sampled. Weighting allows us to interpret our results as roughly representative for each province and the nation.

Colours are used throughout to indicate percentages of children in each ELOM 4&5 band, using the following key:

[62] Early Learning Programmes in South Africa are not classified by quintiles, but given our sampling strategy we will be referring to ELPs as quintile 1-5 ELPs based on their stratification.

Figure 6: *Colour-coded key for figures*

Percentages of children in each ELOM 4&5 band are also indicated on the frequency histograms that are used to report distributions of scores. (For instance, for ELOM 4&5 Total Score, the percentage of children nationally who are *Falling Far Behind* is 28.3%.) Each frequency histogram has an estimated (Gaussian kernel) density curve overlaid, but the bandwidth is kept constant, and should be considered only a rough estimate.

Descriptive statistics are reported for the ELOM 4&5 Total Score (mean, SD, median and the 10th (p_10) and 90th (p_90) percentile points).

2. Early Learning - national outcomes

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

2.1. Total ELOM

Table 11: National: Descriptive statistics for Total ELOM 4&5 Score

_	Mean	SD	SE	Median	p_10	p_90	N
Total	44.62	13.74	0.45	44.39	26.94	63.14	5,139
Boys	43.30	13.50	0.51	43.01	25.95	61.55	2,486
Girls	45.86	13.85	0.53	45.97	28.12	64.51	2,653
Quintile 1	42.68	13.27	0.74	41.31	25.88	59.99	1,727
Quintile 2	44.21	13.51	0.78	44.04	26.59	62.41	1,250
Quintile 3	44.19	13.16	0.74	44.65	27.26	61.55	1,144
Quintile 4	45.39	14.36	1.41	45.29	26.72	65.04	495
Quintile 5	49.30	14.66	1.57	50.50	30.39	67.22	523

Note: The Total ELOM 4&5 Score ranges in theory from 0 to 100, but the minimum and maximum observed scores in this sample were 6.37 and 94.86.

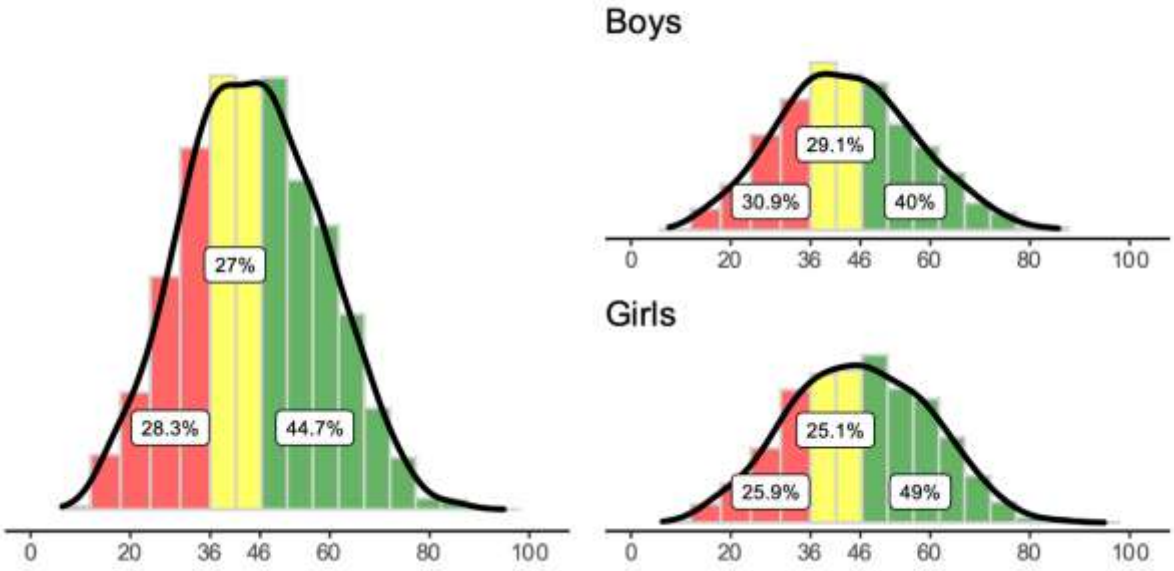


Figure 7: *National: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

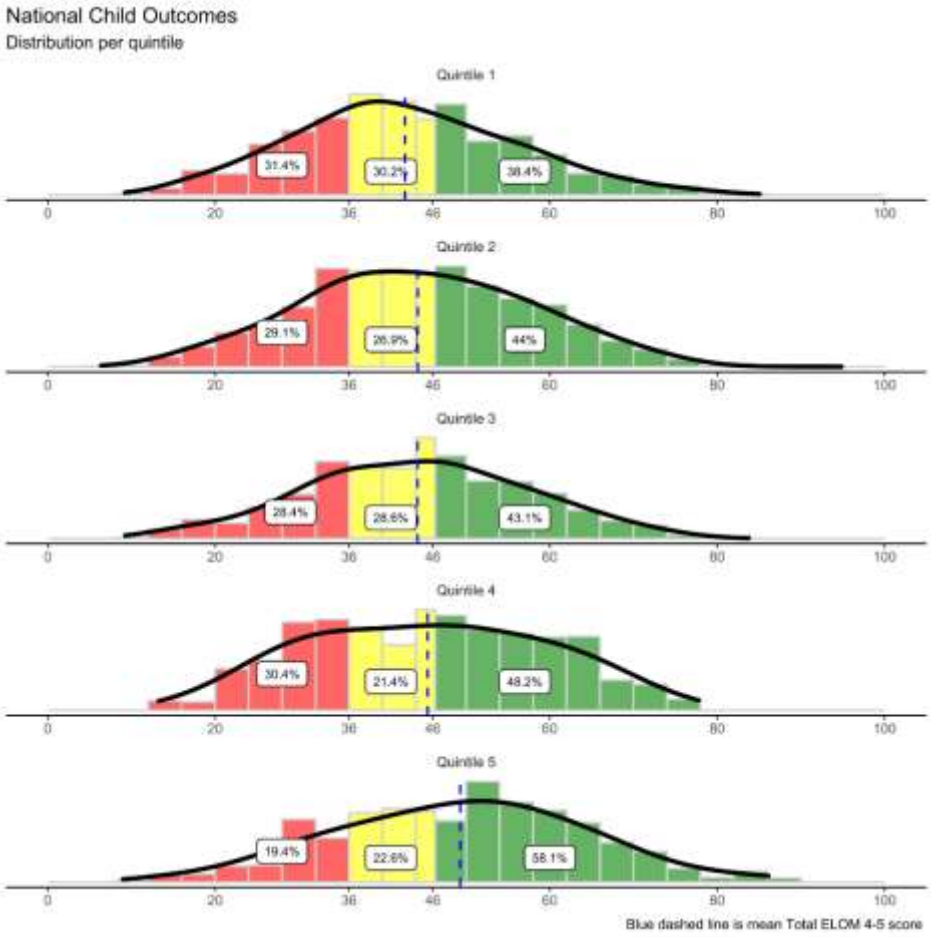


Figure 8: *National: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by quintile*

A child's performance on each item in each of the five ELOM 4&5 domains is awarded a raw score, which is then transformed into a scaled score. In each domain, Item scaled scores are summed to provide a domain scaled score out of 20. In theory, scores for each ELOM domain range from 0-20, while the Total ELOM 4&5 Score ranges from 0-100. Thus, a mean score of 44.62 for the Total ELOM 4&5 should be considered a score of 44.62 out of a possible 100. The five domain scores are then summed to produce the ELOM 4&5 Total scaled score out of 100. Only scaled scores are used in analyses conducted for this report. Further information is available in the ELOM Technical Manual.

Table 11 shows that at the national level:

- The mean ELOM 4&5 Total Score is 44.62 (SD = 13.74).
- Girls perform better than boys with mean scores of 45.86 (SD = 13.85) and 43.30 (SD = 13.50) respectively. This 2.5 point difference represents a sex difference of approximately 20% of an SD, which is small but notable.

ELOM 4&5 Total Scores are approximately normally distributed. Differences exist between the proportions of children who are *On Track* (for achieving the ELOM 4&5 standard), *Falling Behind* and *Falling Far Behind* the expected standard. As can be seen in **Figure 7**:

- Nationally, 44.7% of children's development is *On Track*, while 27% are *Falling Behind* the expected standard and a further 28.3% are *Falling Far Behind* the standard.
- Overall, girls are performing better than boys, with nearly half *On Track* and 25.9% *Falling Far Behind*, while only 40% of boys are *On Track* and 30.9% are *Falling Far Behind*. This trend is also evident in four of the five ELOM 4&5 learning domains, as is discussed below.

As is expected, performance on the ELOM 4&5 improves significantly from lower to higher quintiles. **Table 11** shows:

- Children in quintile 1 ELPs score on average 42.68 (SD = 13.27), while those in quintile 5 programmes score almost 7 points higher with an average of 49.3 (SD = 14.66). This is a statistically significant difference and represents a medium-sized effect (Cohen's d = 0.47).[63]
- 58.1% of quintile 5 children are *On Track* (achieving the ELOM 4&5 standard), and only 19.4% are *Falling Far Behind*, compared with 38.4% of quintile 1 children who are *On Track* and 31.4% who are *Falling Far Behind* the standard.

[63] Cohen (1977, p.24): A Cohen's d value of 0.2 to .49 is considered a "small" effect size, 0.5 to .79 is considered "medium" and 0.8 or greater is a "large" effect size. Cohen, J. (1977). *Statistical power analysis for the Behavioral Sciences*, Revised Edition. Academic Press: New York. Note that while Cohen's values are commonly used, they are not universally accepted.

There is substantive variation in performance across quintiles, as well as there being clear differences between boys and girls favouring the latter.

The following table and figure condense the national picture into a single index of performance.

This composite indicator describes the proportions of children *On Track* for growth and achieving the ELOM 4&5 standard. It includes three categories:

1. Children who **Thrive by Five:** These children are *On Track* for both Early Learning and physical growth.
2. Children who face **Barriers to Thriving:** These children are *On Track* in only one of these areas – either learning or growth.
3. Children who face **Significant Barriers to Thriving:** These children are not *On Track* for both Early Learning and growth.

Table 12*:* Composite Indicator (Learning and Growth)

Indicator status	Percentage	95% lower CI	95% upper CI
Thriving by Five	42.95%	40.24%	45.66%
Barriers to Thriving	53.13%	50.46%	55.80%
Significant barriers to Thriving	3.92%	3.11%	4.73%

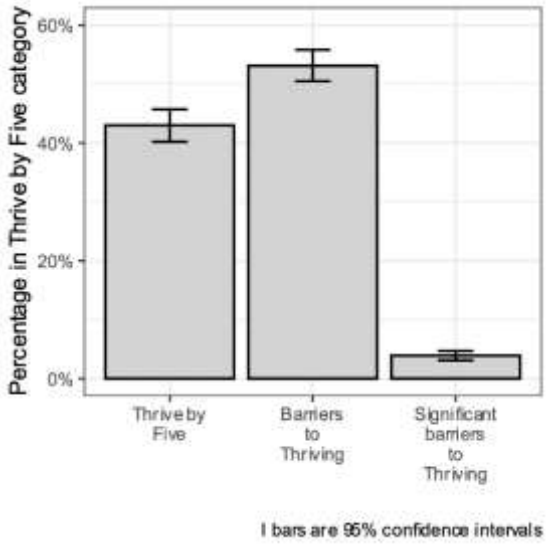


Figure 9: *Index figure for Total ELOM 4&5 Score*

The Thrive By Five Index table and figure can also be shown for quintiles, where quintiles are grouped into quintiles 1-3 (no-fee school clusters) and quintiles 4-5 (since they do not seem to differ much within those ranges on the Total ELOM 4&5 Score, but do differ between ranges).

Table 13: Composite Indicator, per quintile groups

Quintile group	Indicator status	Percentage	95% lower CI	95% upper CI
Quintiles 1-3	Thriving by Five	40%	37.2%	42.8%
Quintiles 1-3	Barriers to Thriving	55.7%	52.9%	58.6%
Quintiles 1-3	Significant Barriers to Thriving	4.3%	3.4%	5.2%
Quintiles 4-5	Thriving by Five	52.4%	45.8%	59%
Quintiles 4-5	Barriers to Thriving	44.9%	39%	50.7%
Quintiles 4-5	Significant Barriers to Thriving	2.8%	0.8%	4.7%

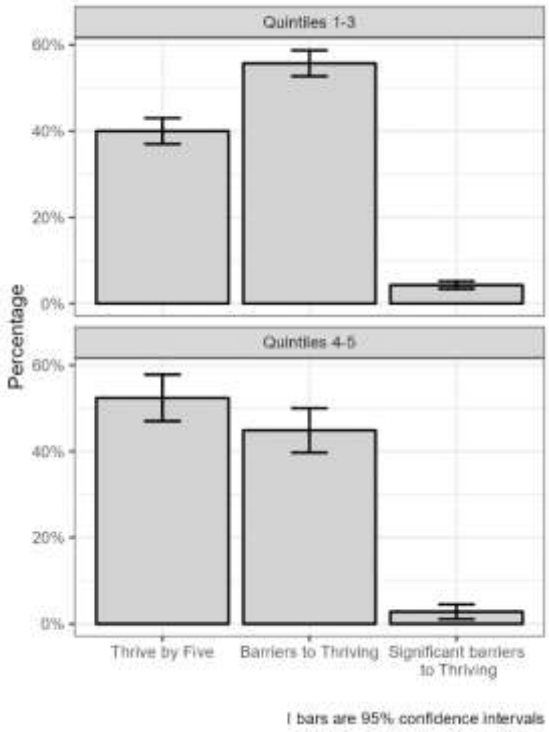


Figure 10: *Index figure for Total ELOM 4&5 Score, per quintile groups*

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

Standard scores for all ELOM 4&5 domains range from 0-20.

2.2. Gross Motor Development

Table 14: *National: Descriptive statistics for Gross Motor Development (score out of 20)*

_	Mean	SD	Median	p_10	p_90	n
Total	8.22	3.91	8.16	2.91	12.97	5,139
Boys	8.28	3.87	8.27	2.91	12.97	2,486
Girls	8.16	3.95	7.75	2.91	12.97	2,653
Quintile 1	8.10	3.78	7.68	2.91	12.92	1,727
Quintile 2	8.25	3.93	8.16	2.91	12.97	1,250
Quintile 3	8.49	3.85	8.67	3.43	12.97	1,144
Quintile 4	8.17	4.06	8.27	2.91	13.70	495
Quintile 5	7.80	4.05	7.60	2.36	12.97	523

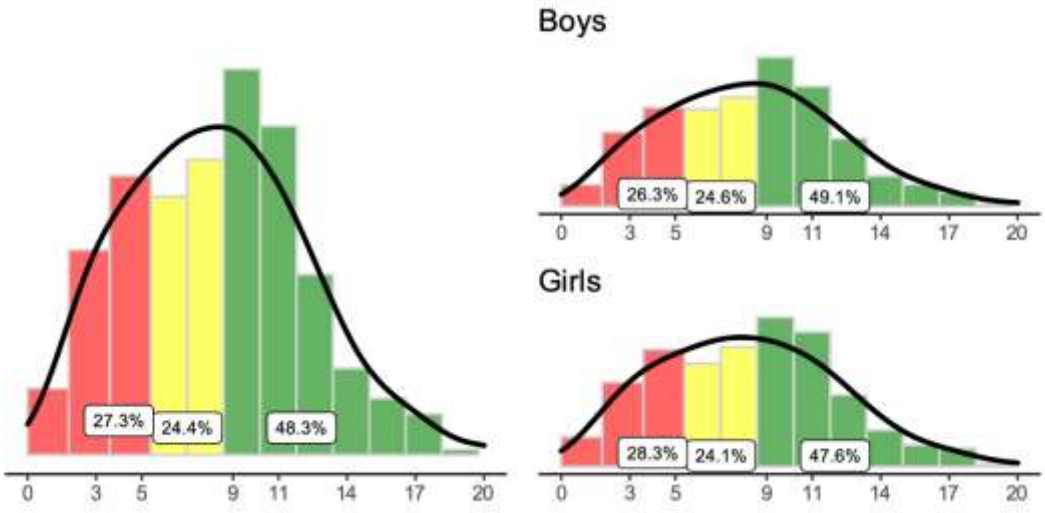


Figure 11: *National: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

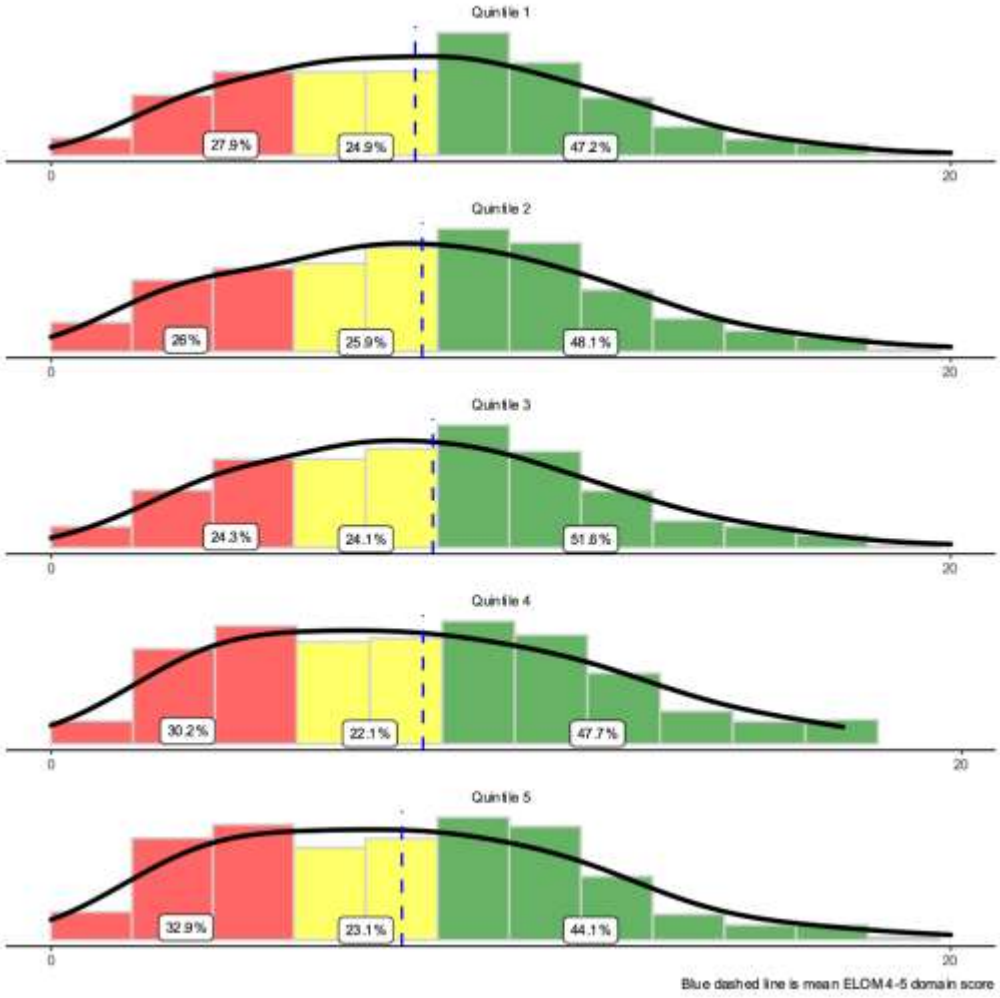


Figure 12: *National: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by quintile*

A score of 8.60 must be achieved to meet the standard for GMD.

- GMD scores have a fairly narrow range across both sex and quintile, with a mean score of 8.22 and SD of 3.91 out of a possible 20 points.
- The distribution of scores is somewhat symmetrical, with a slight skew. ELOM 4&5 bands follow this trend, with 48.3% of children *On Track*, 24.4% *Falling Behind* and 27.3% *Falling Far Behind*.
- Only a slight sex difference is apparent for this domain. The score distributions are similar for boys and girls, with boys scoring slightly higher.
- Some slight differences are apparent across quintiles, with quintile 5 children perhaps scoring slightly lower than the other quintiles.

2.3. Fine Motor Coordination and Visual Motor Integration

Table 15: *National: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration (out of 20)*

_	Mean	SD	SE	Median	p_10	p_90	n
Total	11.01	3.57	0.10	10.73	6.52	16.38	5,139
Boys	10.51	3.47	0.11	10.72	5.86	15.85	2,486
Girls	11.48	3.60	0.12	11.27	6.53	16.50	2,653
Quintile 1	10.53	3.60	0.19	10.29	5.86	15.96	1,727
Quintile 2	10.86	3.51	0.15	10.73	6.52	16.27	1,250
Quintile 3	10.80	3.35	0.18	10.73	6.23	15.41	1,144
Quintile 4	11.50	3.61	0.29	11.27	6.52	16.50	495
Quintile 5	12.22	3.73	0.34	11.92	6.95	17.06	523

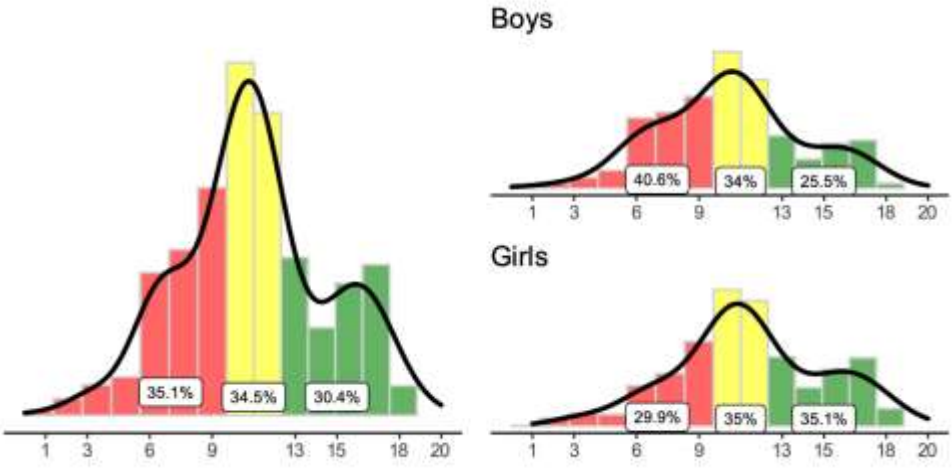


Figure 13: *National: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

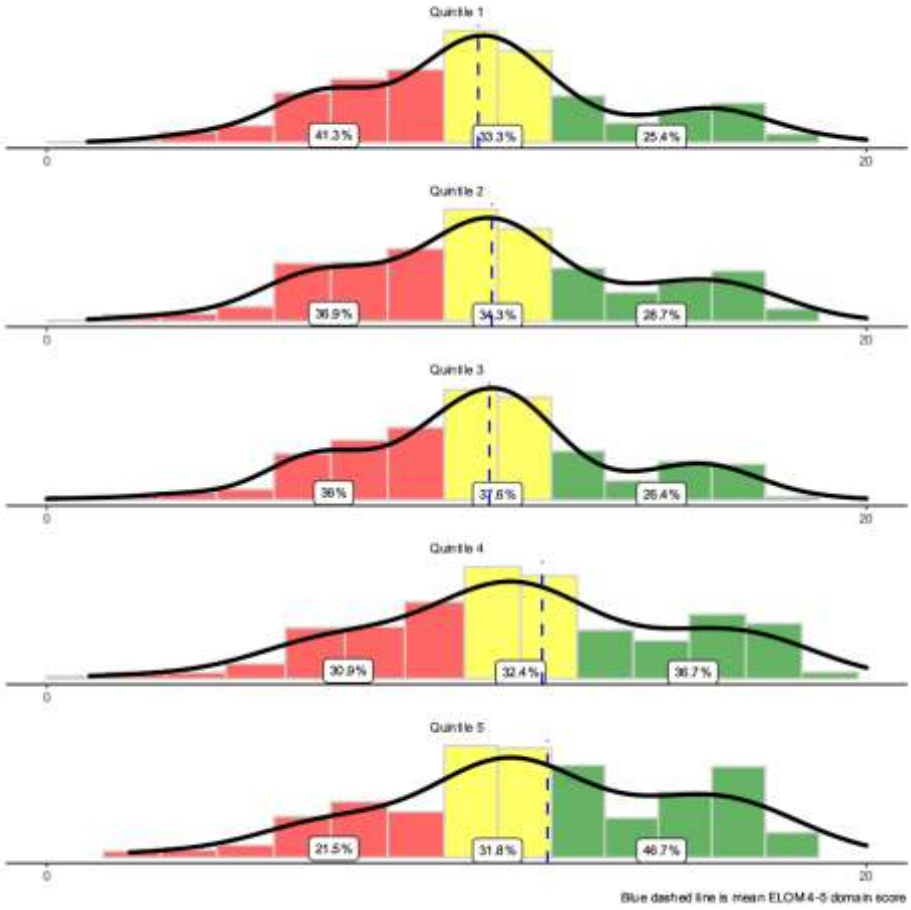


Figure 14: *National: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by quintile*

A score of 12.32 must be achieved to meet the standard for FMC-VMI.

- Across the sample, the mean score for this domain is 11.01 (SD = 3.57).
- Boys score lower, with a mean of 10.51 (SD = 3.47), whereas girls score higher, with a mean of 11.48 (SD = 3.60). This is a fairly small difference (Cohen's d = 0.27).
- FMC-VMI mean scores show a social gradient, increasing from 10.53 (SD = 3.60) in quintile 1 children to 12.22 (SD = 3.73) in quintile 5 children.

There is a notable difference in the distribution of ELOM 4&5 bands between boys and girls and between quintiles:

- Girls fare better than boys with 35.1% *On Track* and 29.9% *Falling Far Behind*, while 25.5% of boys are *On Track* and as many as 40.6% are *Falling Far Behind*.
- Children in quintile 1 demonstrate a much greater chance of *Falling Far Behind* (41.3%), with only 25.4% being *On Track*, compared with those in quintile 5 (21.5% *Falling Far Behind*, while 46.7% are *On Track*).

2.4. Emergent Numeracy and Mathematics

Table 16: *National: Descriptive statistics for Emergent Numeracy and Mathematics (score out of 20)*

_	Mean	SD	SE	Median	p_10	p_90	n
Total	7.92	3.78	0.12	7.92	2.65	13.46	5,139
Boys	7.69	3.69	0.14	7.66	2.65	12.53	2,486
Girls	8.14	3.84	0.15	7.92	2.65	13.57	2,653
Quintile 1	7.61	3.74	0.22	7.66	2.65	12.34	1,727
Quintile 2	8.10	3.69	0.17	7.92	3.47	13.57	1,250
Quintile 3	7.76	3.70	0.23	7.69	2.38	12.43	1,144
Quintile 4	7.86	3.93	0.35	7.81	2.38	13.57	495
Quintile 5	8.59	3.92	0.37	8.26	3.80	13.69	523

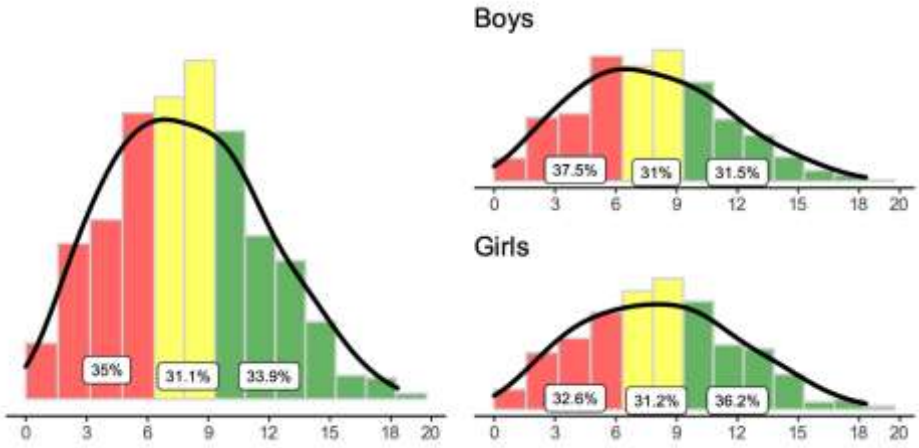


Figure 15: *National: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

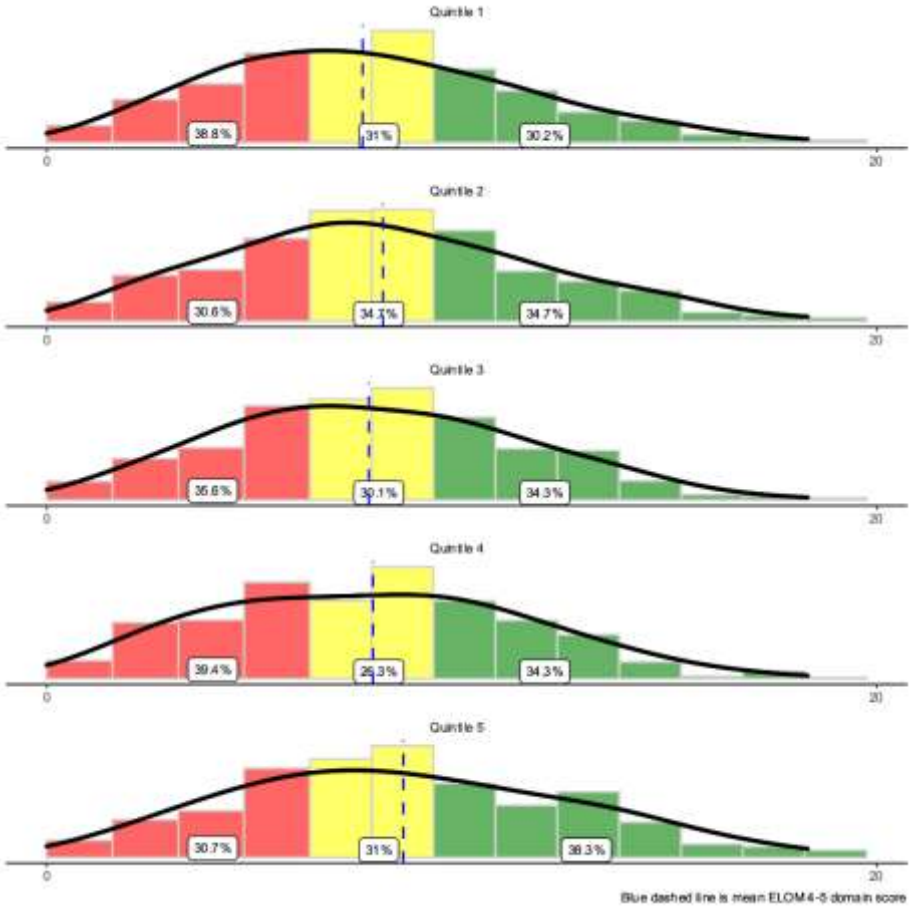


Figure 16: *National: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by quintile*

A score of 9.30 must be achieved to meet the standard for ENM. A similar general pattern to that for the Total ELOM 4&5 Score distribution is evident in some respects:

- The mean score in this domain for the whole sample is 7.92 (SD = 3.78).
- Overall, 33.9% of children achieve the ENM standard and are *On Track*. Of some concern, given the influence of this domain on later school performance, is that 31.1% are *Falling Behind* and 35% are *Falling Far Behind*; 66.1% of children do not meet the standard.
- Once again, boys score lower, with a mean of 7.69 (SD = 3.69), whereas girls score higher, with a mean of 8.14 (SD = 3.84). This difference is very small (Cohen's d = 0.12). A greater proportion of girls are *On Track* (36.2%), while 32.6% are *Falling Far Behind*; 31.5% of boys are *On Track* and 37.5% are *Falling Far Behind*.
- As with the Total ELOM 4&5 Scores, a social gradient is evident in this domain, with the mean for quintile 1 children = 7.61 (SD = 3.74) and that for quintile 5 children = 8.59 (SD = 3.92). It also seems as if the advantage in this domain is only at the top end of the income distribution (quintile 5), with children in quintile 4 performing very similarly to children in quintiles 2 and 3.

- Note the large SD in relation to the mean scores here, which indicates considerable variation *between individuals*. In particular, the difference between the mean scores for boys and girls is much smaller than the differences *within* the samples of boys and girls.

2.5. Cognition and Executive Functioning

Table 17: *National: Descriptive statistics for Cognition and Executive Functioning (score out of 20)*

_	Mean	SD	SE	Median	p_10	p_90	n
Total	6.95	4.01	0.12	6.48	2.11	12.77	5,139
Boys	6.67	3.96	0.13	6.29	2.11	12.61	2,486
Girls	7.23	4.03	0.15	6.63	2.26	12.77	2,653
Quintile 1	6.33	3.78	0.20	6.05	2.11	11.75	1,727
Quintile 2	6.67	3.87	0.20	6.29	2.11	11.75	1,250
Quintile 3	6.73	3.85	0.21	6.29	2.11	12.61	1,144
Quintile 4	7.53	4.05	0.29	7.05	2.26	12.84	495
Quintile 5	8.64	4.44	0.54	8.24	3.11	15.12	523

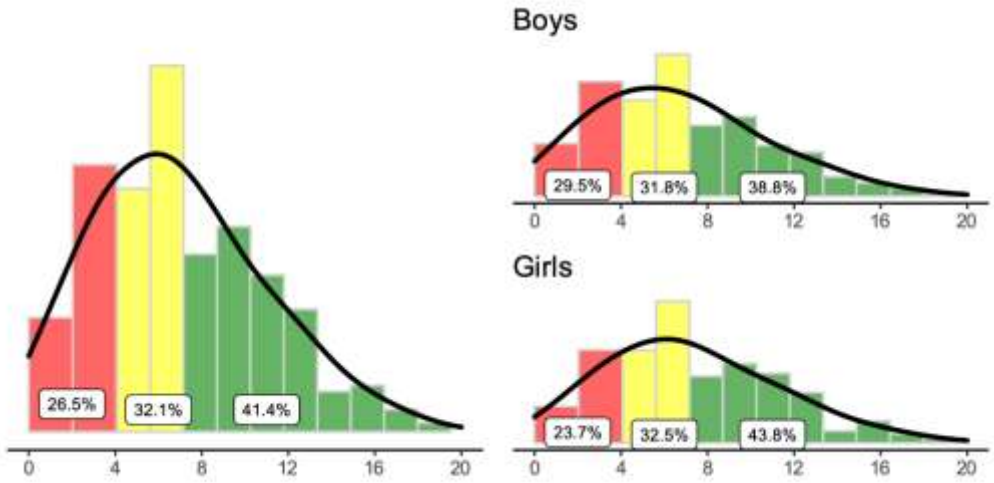


Figure 17: *National: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

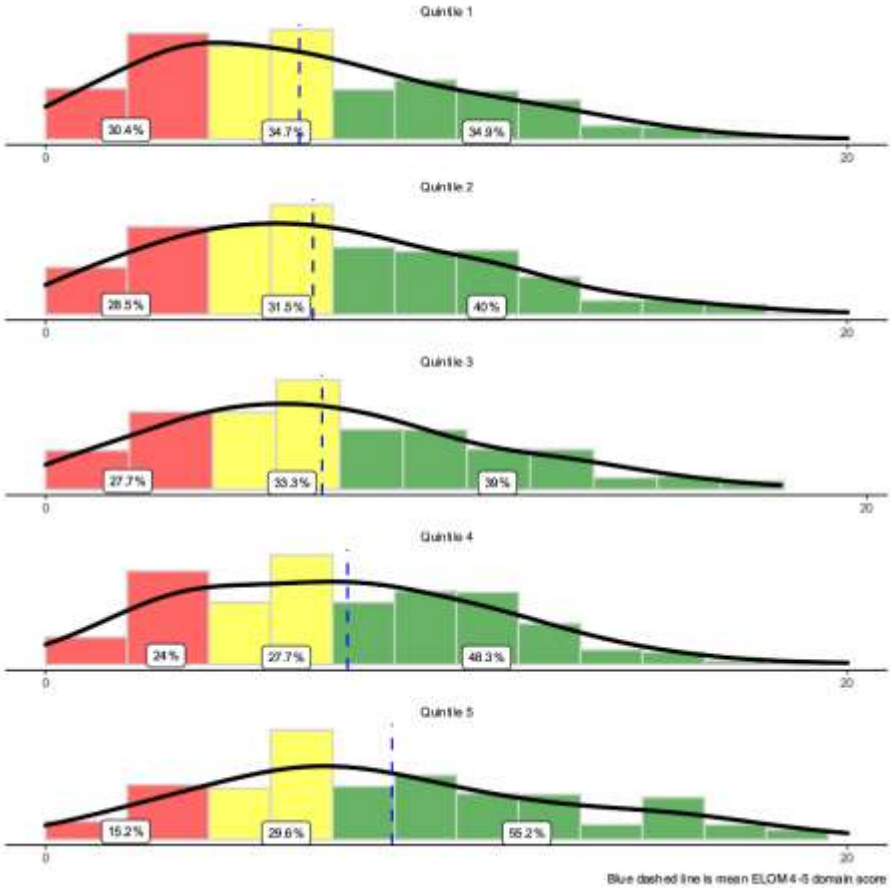


Figure 18: *National: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by quintile*

A score of 7.17 must be achieved to meet the standard for CEF. Overall, scores are relatively low, but many children are *On Track*, particularly those in quintile 4 and 5 ELPs.

- On average, children score only 6.95 (SD = 4.01) out of a possible 20.
- Again, we see a sex difference, with girls outperforming boys. Girls achieve a mean CEF score of 7.23 (SD = 4.03), with 43.8% of the sample *On Track* and 23.7% *Falling Far Behind*. Boys, on the other hand, achieve a mean score of 6.67 (SD = 3.96, Cohen's d = 0.14), but only 38.8% are *On Track*, 31.8% are *Falling Behind* and 29.5% are *Falling Far Behind*.

Quintile differences are also apparent:

- A very steep social gradient is evident for this domain. Average CEF scores increase from 6.33 (SD = 3.78) for quintile 1 children to 8.64 (SD = 4.44) for quintile 5 children. Here, attention should be paid to the large SDs within quintiles, which indicate large variation in individual scores within quintiles.
- Children in quintile 1 have a greater chance of *Falling Far Behind* (30.4%), with only 34.9% *On Track* and achieving the standard.

- In quintile 5 children, only 15.2% are *Falling Far Behind*, 29.6% are *Falling Behind* and a fairly high 55.2% are *On Track* to meet the expected standards for CEF.

2.6. Emergent Literacy and Language

Table 18: *National: Descriptive statistics for Emergent Literacy and Language*

_	Mean	SD	SE	Median	p_10	p_90	n
Total	10.53	4.45	0.13	10.60	4.87	16.66	5,139
Boys	10.16	4.39	0.16	10.47	4.66	16.30	2,486
Girls	10.87	4.48	0.15	10.93	4.87	16.78	2,653
Quintile 1	10.11	4.36	0.23	10.39	4.66	16.09	1,727
Quintile 2	10.33	4.38	0.23	10.47	4.87	16.65	1,250
Quintile 3	10.41	4.35	0.23	10.60	4.87	16.65	1,144
Quintile 4	10.34	4.59	0.42	10.47	4.87	16.66	495
Quintile 5	12.05	4.56	0.48	12.67	5.91	18.28	523

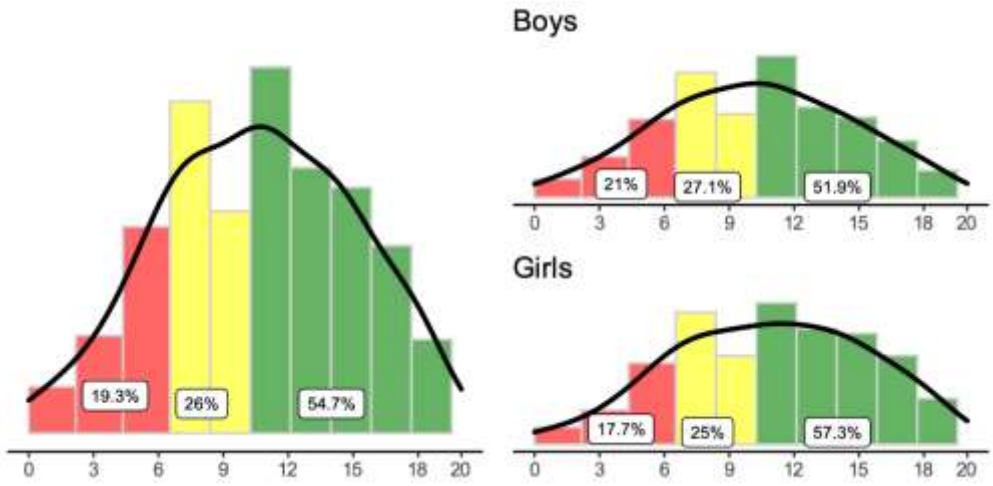


Figure 19: *National: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

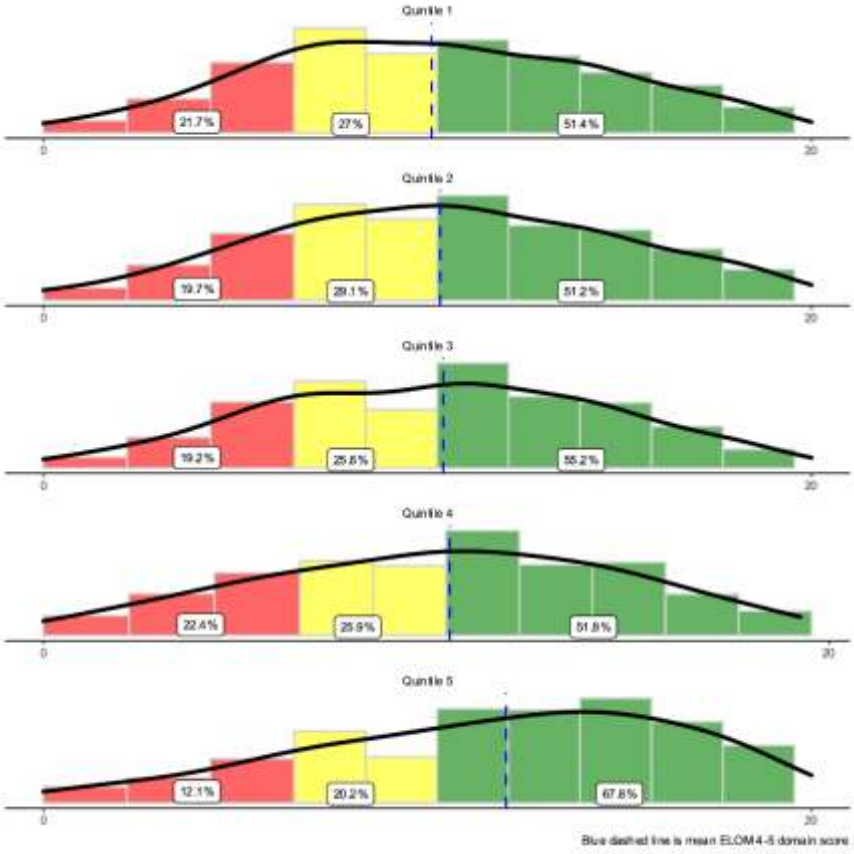


Figure 20: *National: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by quintile*

A score of 10.26 must be achieved to meet the standard for ELL.

Children performed relatively well on the ELL domain:

- The difference between girls and boys is quite small and the mean score is 10.53 (SD = 4.45). Boys scored a mean of 10.16 (SD = 4.39) and girls scored a mean of 10.87 (SD = 4.48).

The ELL scores show the expected pattern across quintiles:

- The mean for quintile 1 children is 10.11 (SD = 4.36), increasing to a mean of 12.05 (SD = 4.56) for quintile 5 children. This is a medium-sized effect (Cohen's d = 0.43).

The distribution of ELOM 4&5 bands is promising for this domain:

- Overall, 54.7% are *On Track* (57.3% of girls and 51.9% of boys), and only 19.3% are *Falling Far Behind* (17.7% of girls and 21% of boys).

- As is expected, children in quintile 1 demonstrate a greater chance of *Falling Far Behind* (21.7%, but with 51.4% *On Track*), while in quintile 5 there are 12.1% *Falling Far Behind* and a substantial 67.8% of children are *On Track*.

In sum, analysis of ELOM 4&5 Total Scores in this study shows that the development of *less than 50%* of South African children attending known ELPs is *On Track*. In line with the international literature, *girls outperform boys*, with 9% more *On Track* and achieving the ELOM 4&5 standard. Apart from the GMD domain, in which boys tend to outperform girls, this pattern remains in the other domains. A social gradient is evident across the board, with children in the higher quintiles outperforming the rest.

Poor performance in domains related to later school achievement is of considerable concern – particularly for those children in lower quintiles. That said, there is considerable interindividual variation in performance on the ELOM 4&5, with the development of a proportion of children in all five quintiles being *On Track* in Early Learning domains.

3. Social and emotional functioning

Question 3: What proportion of children meet the expected score for Social Relations with Peers and Adults?

The table and figures below address this question, disaggregated by sex.

3.1. Social relations

Table 19: National: Social Relations

_	Don't meet standard	Meet standard	Lower 95% CI[64] limit	Upper 95% CI limit
Total	27.5%	72.5%	69.5%	75.5%
Boys	32.4%	67.6%	64%	71.1%
Girls	22.8%	77.2%	74.1%	80.3%

Nationally:

- 72.5% meet the expected score for Social Relations with Peers and Adults, whereas 27.5% do not.
- Girls are more likely to meet this standard (77.2%) than boys (67.6%).

[64] CI = confidence interval.

For this domain, we don't see the same socio-economic gradient playing out as we do in the learning domains, and *fewer* children from quintiles 4 and 5 achieve the expected score.

Question 4: What proportion of children meet the expected score for their Emotional Readiness for School?

The table and figures provide results for this question, disaggregated by sex.

3.2. Emotional readiness

Table 20: National: emotional readiness

_	Don't meet standard	Meet standard	Lower 95% CI limit	Upper 95% CI limit
Total	33.4%	66.6%	64.2%	69.0%
Boys	37.3%	62.7%	59.5%	65.9%
Girls	29.7%	70.3%	67.6%	73.0%

Nationally:

- 66.6% of children meet the expected score for Emotional Readiness for School, while 33.4% do not.
- Girls are more likely to meet this standard (70.3%) than boys (62.7%).

3.3. Social relations and emotional readiness (combined)

We have created a composite score of social and emotional functioning which combines social relations and emotional readiness. Social relations and emotional readiness were each converted to a score out of 12 and then summed to compute a new score out of 24. The resulting combined variable is labelled "Social-Emotional Functioning". The table below reports the distribution at the national level.

Table 21: National: Social-Emotional Functioning

_	Mean	SD	Median	p_10	p_90	n
Total	19.20	3.93	20.0	14.0	24.0	5,139
Boys	18.74	4.05	19.5	13.5	24.0	2,486
Girls	19.63	3.76	20.5	14.5	24.0	2,653

Nationally:

- Children score 19.2 out of 24 on the combined socio-emotional variable.
- Girls score slightly higher than boys.
- Children in different quintiles score similarly, with a narrow range of scores between 18.8 and 19.4.

4. Physical growth (height-for-age)

Question 5: What proportion of children demonstrate normal growth, moderate stunting and severe stunting?

Table 22: National: Physical Growth

	Severely Stunted	Moderately Stunted	Normal HFA[65]	Lower 95% CI limit	Upper 95% CI limit
Total	0.53%	5.12%	94.36%	93.40%	95.31%
Boys	0.36%	5.09%	94.56%	93.27%	95.84%
Girls	0.69%	5.15%	94.17%	92.98%	95.36%
Q 1	0.68%	5.45%	93.87%	92.18%	95.56%
Q 2	0.45%	5.75%	93.80%	92.00%	95.60%
Q 3	0.29%	5.70%	94.02%	91.94%	96.10%
Q 4	0.77%	3.95%	95.29%	91.25%	99.32%
Q 5	0.70%	3.10%	96.21%	94.26%	98.16%

Table 23: Provinces: Physical Growth

	Severely Stunted	Moderately Stunted	Normal HFA	Lower 95% CI limit	Upper 95% CI limit
Eastern Cape	0.74%	9.24%	90.02%	87.10%	92.94%
Free State	0.90%	6.98%	92.13%	89.24%	95.01%
Gauteng	0.48%	5.19%	94.33%	91.33%	97.33%
KwaZulu-Natal	0.05%	1.90%	98.05%	96.97%	99.14%
Limpopo	1.00%	6.49%	92.51%	90.19%	94.82%
Mpumalanga	0.51%	2.83%	96.66%	94.85%	98.48%
North West	0.13%	5.71%	94.16%	92.21%	96.11%
Northern Cape	0.30%	6.01%	93.69%	90.92%	96.45%
Western Cape	0.86%	4.38%	94.77%	92.46%	97.08%

[65] It is useful to note that the WHO defines severe stunting as being when normalised HFA < -3SD (i.e., ZHFA < -3), and stunting as being when normalised HFA < -2SD (i.e., ZHFA < -2). Rough translations of these into expected percentages would mean that in a normal population we would expect 0.13% to be severely stunted and 2.3% to be stunted. Note that we do not show results here for the category 'mild stunting', but see the modelling section later in the report.

The WHO-reference standard (HFAZ) was computed for the sample.

Nationally:

- 94.36% of children are of normal HFA.
- 5.12% have moderately stunted growth, and 0.53% are severely stunted.
- Overall, one in eighteen children in this study is identified as potentially having long-term malnutrition.
- More children have stunted or severely stunted growth in the lower quintiles than upper quintiles.

Provincially:

- Children's health and development is most compromised in those who reside in the Eastern Cape, where 9.9% of children are either stunted or severely stunted, and the Free State and Eastern Cape (at least 7.49% in both provinces). Rates of severe stunting are highest in Limpopo, with 1% of children being severely stunted.
- KwaZulu-Natal shows that 98.05% of children have normal HFA.

Thrive by Five stunting rate is considerably lower than the 27% reported for the under-five population in the 2016 South African Demographic and Health Survey (Hall et al., 2019).[66] As only children aged between 50 and 59 months were measured in the present study, the findings may not be directly comparable.

However data from the South African National Income Dynamics Study (NIDS) provides some comparison. Over five waves of the study (2008-2017), the rate for children under three years varies from 16 to 18 per cent while that for 4-6 year olds ranges from 10 to 13 per cent.

Both local and international studies show degrees of growth recovery ('catch-up') between infancy and toddlerhood and age five. Both the NIDS and the Birth to Twenty Cohort study findings provide evidence of substantial catch-up growth through early childhood (Casale, 2016; Desmond & Casale, 2017; Casale 2020)[67]. The Young Lives study findings from four low-and-middle income countries shows that between 27 and 40 per cent of children recover from stunting at 12 months by age five (Benny Boyden & Penny, 2018)[68].

---

[66] Hall, K., Sambu, W., Almeleh, C., Mabaso, K., Giese, S., & Proudlock, P. (2019). South African Early Childhood Review 2019. Cape Town: Children's Institute, University of Cape Town and Ilifa Labantwana. https://ilifalabantwana.co.za/sa-early-childhood-review-2019/

[67] Casale, D. and Desmond, C. (2016) Recovery from stunting and cognitive outcomes in young children: evidence from the South African Birth to Twenty Cohort Study. Journal of Developmental Origins of Health and Disease 7: 163-171. Casale, D. (2016). Analysing the links between child health and education outcomes: Evidence from NIDS Waves 1-4. Cape Town: SALDRU, University of Cape Town. SALDRU Working Paper Number 179/ NIDS Discussion Paper 2016/6. Casale, D. (2020). Recovery from stunting in early childhood and subsequent schooling outcomes: Evidence from NIDS Waves 1–5, Development Southern Africa, 37:3, 483-500, DOI: 10.1080/0376835X.2020.1715790.

[68] Benny, L., Boyden, J., &, Penny, M. (2018) Early is best but it's not always too late: Evidence on nutrition and growth from the Young Lives study in Ethiopia, India, Peru and Vietnam, Summative Report. Oxford: Young Lives.

The Thrive by Five data is cross-sectional. We do not have growth data of children at earlier points in development. However, it is very probable that our findings of much lower stunting rates than national surveys of children under five may reflect catch-up growth.

The figures reported here include only moderately and severely stunted children. This is in line with most policy-related research on child growth, which focuses on the implications for development of moderate and severe growth stunting. But as Stevens et al. (2012, p.824) [69] point out, "the hazardous effects of undernutrition happen along a continuum of mild, moderate, and severe undernutrition." The implication is that mild stunting (HFAZ below 1 Standard deviation of the median of the WHO reference population) should not be ignored as it could be a barrier to thriving.

Almost one in five children in the Thrive by Five sample showed signs of mild stunting. Findings from the NIDS study (Casale, 2020) reinforce the importance of attending to this group of children. Casale classified children's catch-up by 4 to 5 years as incomplete (p. 6) if they were mildly stunted. She reports that children in the 'incomplete catch up' group did worse on education outcome measures (grade completion and failure) "compared to the children who were never stunted" (p. 14). Most important, there was also little difference in education outcomes between this group and those who remained stunted.

Finally, Subramanian, Karlsson and Kim (2022, p. e179[70]) observe that "By definition (following the WHO normative distribution), the stunting prevalence among children living in ideal environments is expected to be around 2·3%." One can apply this estimate to South Africa to judge our distance from this rate. In Thrive by Five, we find 5.65% of the children fall below the 2SD cut-point for stunting. If this number is representative, it would mean that some 2.5% of 1.2 million children (30 000 children) in this age group in ELPs in South Africa are below the cut-point for stunting.

5. Exploring potential predictors of learning outcomes (ELOM 4&5 scores)

To investigate the potential predictors of ELOM 4&5 scores we began by exploring the data graphically. Figures allow us to map multiple variables into an axis space to see whether potential patterns exist and whether certain predictors covary with others in interesting ways. The following figures consist of scatterplots (with fitted regression lines), which map up to three variables into the axis space, as well as boxplots, which allow us to visualise the distributions of continuous variables across categories such as sex and quintile.

---

https://assets.publishing.service.gov.uk/media/5b9a8b6040f0b6788dda2bc5/Nutrition_and_Growth_Summative_Report_June_2018_0.pdf

[69] Stevens, G. A., Finucane, M. M., Paciorek, C. J., Flaxman, S. R., White, R. A., Donner, A. J., Ezzati, M., Nutrition Impact Model Study Group. (2012). Trends in mild, moderate, and severe stunting and underweight, and progress towards MDG 1 in 141 developing countries: a systematic analysis of population representative data. *The lancet, 380*(9844), 824-834. https://doi.org/10.1016/S0140-6736(12)60647-3

[70] Subramanian, S. V., Karlsson, O., & Kim, R. (2022). Revisiting the stunting metric for monitoring and evaluating nutrition policies. The Lancet Global Health, 10(2), e179-e180. DOI: https://doi.org/10.1016/S2214-109X(21)00504-0

5.1. Relationship between ELOM 4&5 Total and sex

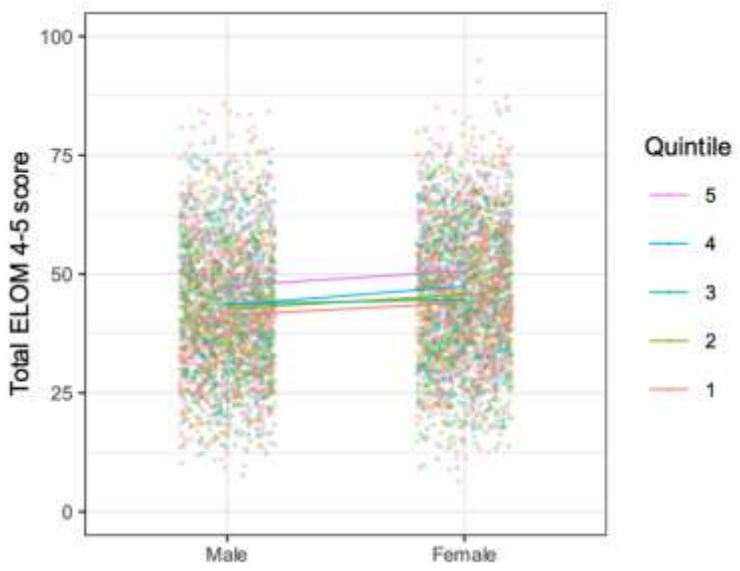
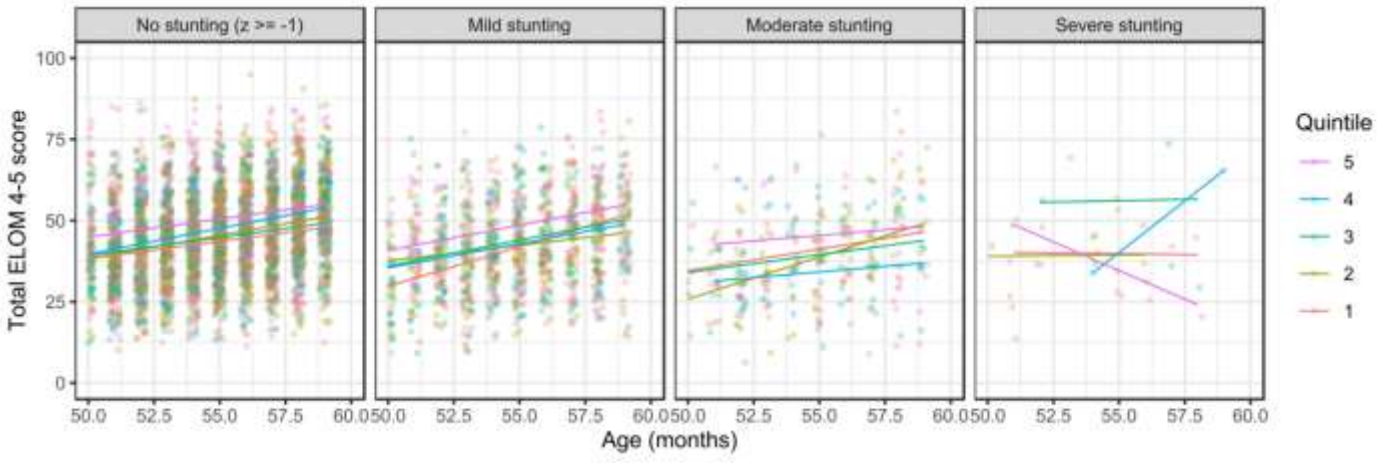


Figure 21: *National ELOM 4&5 Total Score by sex*

The figure above shows the differences between ELOM 4&5 Total Scores across child's sex, with quintile colour-coded to show an additional potential dependency on quintile. Here we can see that, on average, girls tend to do better on the ELOM 4&5 than boys. This is the case across all domains, except GMD, and particularly for girls in quintiles 4 and 5, who perform markedly better than all other children in quintiles 1, 2 and 3. A notable part of the picture, though, that should not be ignored, is the large amount of variation in ELOM 4&5 Total Scores among children within sex and quintile categories.

5.2. Relationship between ELOM 4&5 Total, age and growth status



Note: We are including the 'mild stunting' category in this figure, which some researchers would not consider to be a stunting category of sufficient interest. We believe that the figure above shows it is an important category. For stunting definitions see Table 6

Figure 22: *National ELOM 4&5 Total Score by age and growth status*

The figure above shows the relationship between ELOM 4&5 Total Scores and age, for children of both non-stunted and classes of stunted growth status. Note that there are very few cases in the severely stunted category, making the pattern seen there uncertain. Note also that we are displaying results for the 'mild stunting' category, too. As is expected, ELOM 4&5 Total Scores are positively related to age. ELOM 4&5 Total Scores increase with age and this is true regardless of stunting effects. However, differences are evident in ELOM 4&5 scores between children who are not stunted and those who are stunted: Both mild and moderately stunted children start out with lower scores than their counterparts at age 50 months (lower intercept values), and these differences are worse for greater stunting and persist as children get older. However, it is promising that stunted children of higher ages do better than stunted children of lower ages, suggesting that the effect of stunting is perhaps less deleterious to ELOM 4&5 performance than first thought.

A socio-economic gradient is present, with systematically higher performance from children in quintile 1 through to those in quintile 5. This is more clearly the case for the quintile_natemis variable, as shown below.

The change in Total ELOM 4&5 performance over age groups is worth pointing out. Considering just the children who are not in any stunted category (i.e., with height for age z ε -1), with unweighted data, we find:

- At age 50 months, for children who are not stunted in Q1, mean ELOM 4&5 Total Score = 40.87 (SD = 12.84, n = 55).
- At age 50 months, for children who are not stunted in Q5 mean ELOM 4&5 Total Score = 52.61 (SD = 16.16, n = 29). This is a difference of 11.75 points between Q1 and Q5.
- At age 59 months, for children who are not stunted in Q1, mean ELOM 4&5 Total Score = 48.17 (SD = 12.54, n = 94).
- At age 59 months, for children who are not stunted in Q5 mean ELOM 4&5 Total Score = 59.15 (SD = 14.63, n = 24). This is a difference of 10.98 points between Q1 and Q5.
- The improvement in Total Score from age 50 to age 59 months for Q1 children = 7.3 points. The improvement in Total Scores from age 50 to age 59 months for Q5 children = 6.54 points.

From 50 to 59 months, children who are not in any stunted category in both quintile 1 and quintile 5 improve by approximately 7 points. This equates to approximately 0.7 points per month, which can be attributed to age-related developments. Thus, age and socio-economic status have a notable impact on ELOM 4&5 Total Scores, in addition to Early Learning programming benefits (discussed below).

5.3. Relationship between ELOM 4&5 Total and social-emotional functioning

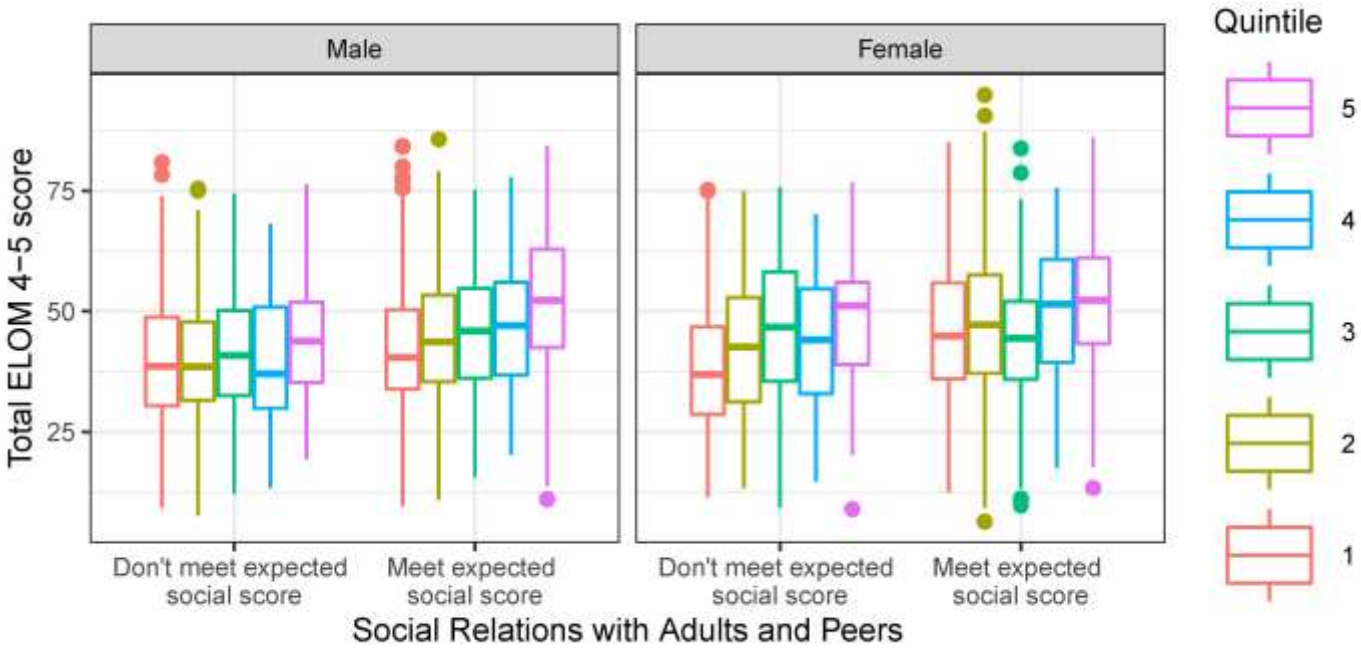


Figure 23: *ELOM 4&5 Total by Social Relations with Adults and Peers*

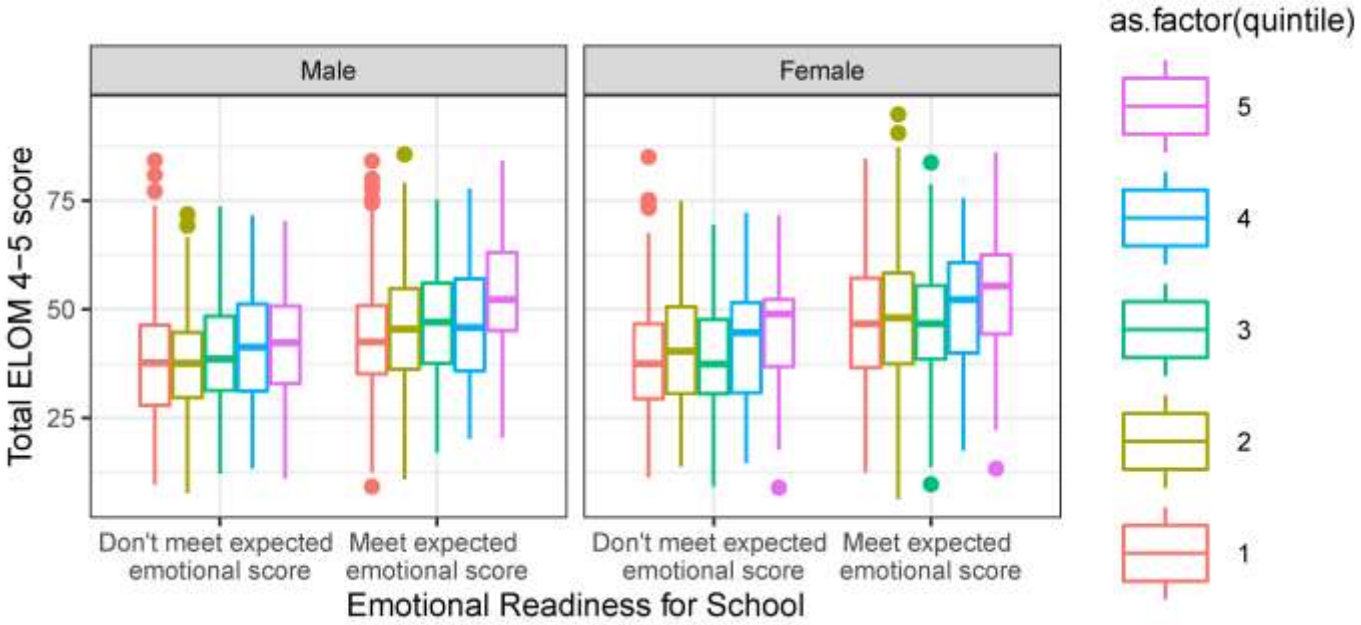


Figure 24: *ELOM 4&5 Total by Emotional Readiness for School*

A difference is evident between children meeting and not meeting the expected score for Social Relations with Peers and Adults on the ELOM 4&5 Total Score, as well as for the expected score for Emotional Readiness for School. In both cases,

children who meet the expected standards perform better than children who do not meet those requirements. There is, nonetheless, also a lot of variation within categories, and overlap between categories on the ELOM 4&5 Total Score.

5.4. Relationship between ELOM 4&5 Total and dosage (cumulative exposure to ECD programme)

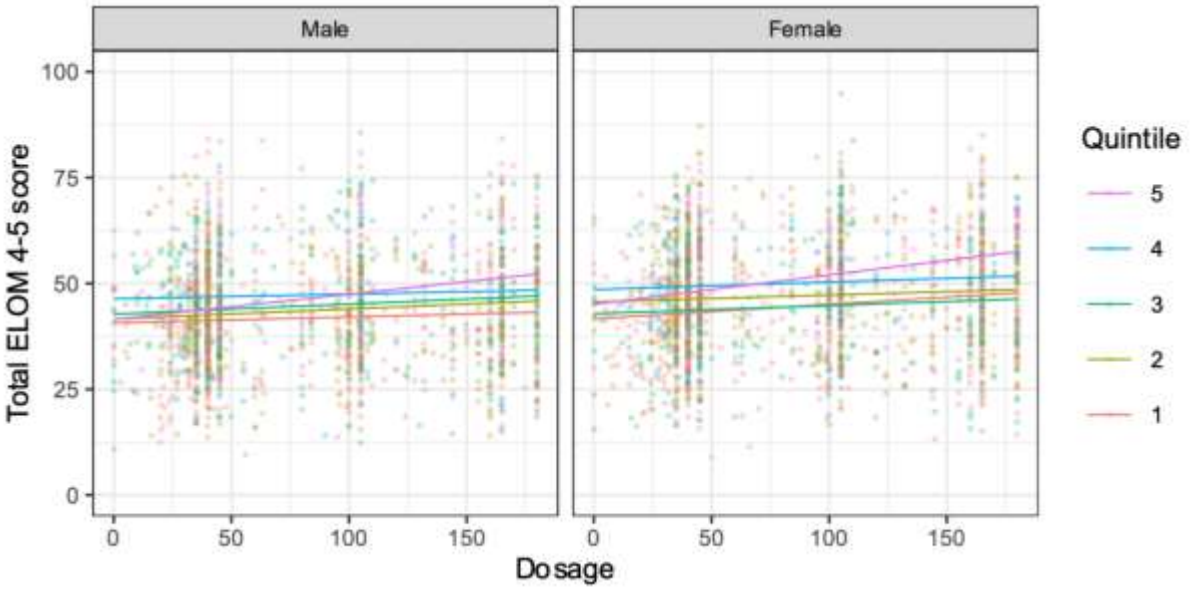


Figure 25: *ELOM 4&5 Total by dosage (cumulative exposure to ELP)*

'Dosage' has been operationalised here as the cumulative exposure to the ELP and is calculated by multiplying the teacher-reported average attendance in the last term by the number of months enrolled (maximum of 36 months [12 months for 3 years]). The variable, number of months the child had been enrolled in the programme, contained some improbable values (specifically, scores above 36 months, indicating that the children had been enrolled for 3 to 5 years in some cases). While these values may reflect cases of children who have been in the ELP from crèche age to the current day, it is more likely to be erroneous data. We therefore truncated these values to create an upper limit of 3 years of enrolment in the ELP (3 years x 12 months = a maximum of 36 months enrolled).

What is evident from the figure above is that there is a varying and perhaps uncertain relationship between exposure to the ELP and ELOM 4&5 performance. Generally, as dosage increases, there is a slight increase in ELOM 4&5 Total Score. This is more pronounced in girls than boys, especially girls in quintile 4 and quintile 5. However, close inspection of the figure shows that there is a lot of scatter present in the data. The patterns which emerge may be meaningful but are weak. Ultimately, it is critical to note that there is a high degree of individual variation in the data, that is, there are far greater differences within groups (e.g., within boys or within girls) than there are between groups. It is important to recognise that this is cross-sectional data. We do not have baseline scores, and we are wary about concluding anything about programme effects from this data. We return to the question of dosage effects in the Appendices to the report.

6. Correlates of ELOM 4&5 Total Scores

In this section we report analyses that consider correlations of ELOM 4&5 Total Scores at the national level with other variables. We start by looking at relations between potential predictors and ELOM 4&5 Total Scores one at a time (i.e., not controlling for any other factors or variables), and then move on to consider potential predictors simultaneously (i.e., in which the tests of significance and the computation of regression coefficients are done with several potential predictors of interest simultaneously).

6.1. Outcome variable and potential predictors

We considered only the ELOM 4&5 Total Score at the national level as an outcome variable, and thus do not report any analyses for subdomains of the ELOM, or for provinces of South Africa, or more granular areal units. This is done in order to capitalise on the maximum statistical power available to us, making estimates of relationships between variables more reliable and more precise. It is also done in order to keep the analysis manageable – there are five subdomains in the ELOM, and there are nine provinces in South Africa, and reporting analyses for each of the 45 or 54 (if including the national level data) resulting combinations would be unparsimonious, and perhaps tedious for the reader, and may also result in increased Type 1 error rates.

We identified the following potential correlates or predictors of performance on the ELOM 4&5 Total Score: age of child, socio-economic status (as indexed by school quintile, see earlier discussion – we treated this as an interval scale to simplify the analysis when computing correlations, although such an assumption is contestable), growth status of child (simplified for the correlation analysis to have two categories, stunted [moderately and severely stunted] vs normal HFA [no stunting, or mildly stunted][71], sex of child, child's social relations (as assessed by the teacher), child's emotional readiness (also assessed by the teacher) and finally, a measure of "dosage", as outlined earlier.

There was a moderately strong correlation (r = 0.57) between child's emotional readiness and child's social relations. We therefore combined the social and emotional scores into a composite score of Social-Emotional Functioning. Social relations and emotional readiness were each converted to a score out of 12 and then summed to compute a new score out of 24. The resulting composite variable, "Social-Emotional Functioning," was used as a predictor.

6.2. Correlates of the Total ELOM 4&5 Score considered one at a time

The correlation matrix shown below reports the correlations between the predictors and the ELOM 4&5 Total Score, as well as between the predictors themselves. Significance tests (from bootstrap methods[72]) of individual correlations are reported with superscripted asterisks, where *** = p < .001, ** = p < .01, and * = p < .05.

[71] In other words, the categories used were Height for age standard (z) score ε -2, and Height for age standard (z) score < -2.

[72] It appears to be more appropriate to compute bootstrap p values for correlations computed on weighted data (Long, 2020).

Table 24: *Correlation matrix for ELOM 4&5 and predictors*

	Total ELOM 4&5	Age	Quintile	Growth	Sex	Social-emotional	Dosage
Total ELOM 4&5	1	0.24***	0.15***	-0.08***	0.08***	0.25***	0.13***
Age (in months)	0.24***	1	-0.01	0.01	-0.03	0.11***	0.07***
Quintile	0.15***	-0.01	1	-0.03	0.01	-0.06***	0.01
Growth status	-0.08***	0.01	-0.03	1	-0.01	0.03*	0
Sex	0.08***	-0.03	0.01	0.01	1	0.1***	0.03
Social-emotional	0.25***	0.11***	-0.06***	-0.03	0.1***	1	0.04*
Dosage	0.13***	0.07***	0.01	0	0.03	0.04*	1

We find that Total ELOM 4&5 Score is positively and significantly correlated with age of child, socio-economic status (as indexed by school quintile, see earlier discussion), growth status of child, sex of child, child's socio-emotional development (as assessed by the teacher) and dosage. These correlations should be taken as a rough indication only of relationships between the variables, as some variables are treated as being on interval scales and it is questionable whether this is appropriate.

Another predictor (not shown here), amount of fees paid to the ELP, was found to be a moderately strong correlate with Total ELOM 4&5 Score (r = 0.3***). However, there was a significant amount of data missing from this variable, as well as from the attendance-related variable which is used to compute dosage (fees_amount_4_6, missing n = 3102 and dosage, missing n = 1393).

Therefore we ran our model without fees or the dosage variable, but we do report a model in the Appendices that considers dosage.

6.3. Correlates of the Total ELOM 4&5 Score considered simultaneously – mixed linear model

In the descriptive statistics reported earlier, we used a sampling weight correction, as explained in the Method section. However, we did not use a weight correction in the regression modelling. There are several reasons for not doing so, and many authors point to disadvantages in including sampling weights for regression models.[73]

[73] Lumley (2010) concludes "… it often makes little practical difference whether sampling weights are used in fitting regression models… when there is a substantive difference [between weighted and unweighted analyses] it may indicate that a few influential observations happen to have large sampling weights, so that neither the weighted nor the unweighted analysis is entirely reliable".

We conducted a mixed linear regression analysis (or mixed linear model) to identify correlates of the Total ELOM 4&5 Score to test and quantify the extent to which the predictors we identified were related uniquely to the Total ELOM 4&5 Score, once taking all other predictors into account. Mixed linear models allow us to investigate effects at the level of the individual but also allow us to take clustering in the data into account.

The outcome variable was the Total ELOM 4&5 Score, and the predictors were as discussed earlier[74]. We did not consider potential interactions or nonlinear relations between predictors and outcome.

The results of the mixed linear analysis are shown in **Table 25** and **Table 26** below. Significance tests of individual predictors are reported with associated p-values, at α = .05.

All the predictors entered into the model significantly predict Total ELOM 4&5 Scores ($p < 0.001$). When running the analyses, we made use of "dummy variables" to represent categorical variables. Note that in this table specific contrasts are shown as effects, e.g., the coefficient for Stunted [Mild stunt vs None] in the table is the coefficient that compares the group that is mildly stunted with the reference group (not stunted).

In order to assess the effects of all levels of categorical variables simultaneously, we conducted omnibus ANOVA tests on predictor terms, and these are shown in the table below.

Table 25: ANOVA summary table for mixed linear modelling of ELOM 4&5 Total

Variable	Chisq	df	p <
Age	251.39	1	.001
Stunted	81.69	3	.001
Quintile_natemis	61.04	4	.001
Sex	35.01	1	.001
Social-emotional combined	621.60	1	.001

[74] However, it should be noted that we used a variable reflecting school quintile that we obtained by augmenting quintile_natemis with scores from quintile_sample. This quintile variable appeared to better reflect the socio-economic gradient of ELPs better than the quintile variable used to create the weights and relied on elsewhere in the report. A re-analysis of the relationship with the quintile variable used to create the weights can be made available on request.

Table 26: Coefficient summary table for mixed linear modelling of ELOM 4&5 Total

Predictors	Total for ELOM over all items						
	Estimates	std. Error	std. Beta	standardised std. Error	CI	standardised CI	p
(Intercept)	-33.68	3.47	-0.15	0.04	-40.48 – -26.88	-0.23 – -0.06	**<0.001**
Age (months)	0.98	0.06	0.19	0.01	0.86 – 1.10	0.17 – 0.21	**<0.001**
Stunted [Mild stunt vs None]	-2.40	0.40	-0.17	0.03	-3.17 – -1.62	-0.23 – -0.12	**<0.001**
Stunted [Mod stunt vs None]	-5.11	0.70	-0.37	0.05	-6.48 – -3.74	-0.47 – -0.27	**<0.001**
Stunted [Severe stunt vs none]	-4.42	1.95	-0.32	0.14	-8.23 – -0.60	-0.59 – -0.04	**0.023**
Quintile natemis [2 vs 1]	0.55	0.76	0.04	0.06	-0.95 – 2.04	-0.07 – 0.15	0.474
Quintile natemis [3 vs 1]	1.90	0.78	0.14	0.06	0.37 – 3.44	0.03 – 0.25	**0.015**
Quintile natemis [4 vs 1]	4.59	1.13	0.33	0.08	2.37 – 6.81	0.17 – 0.49	**<0.001**
Quintile natemis [5 vs 1]	8.48	1.20	0.61	0.09	6.12 – 10.83	0.44 – 0.78	**<0.001**
Sex	1.82	0.31	0.13	0.02	1.21 – 2.42	0.09 – 0.17	**<0.001**
Socioemotional combined	1.20	0.05	0.33	0.01	1.10 – 1.29	0.31 – 0.36	**<0.001**

Random Effects	
σ2	97.75
τ00 id_ecd	48.43
τ00 id_cluster_sample	13.53
ICC	0.39
N id_cluster_sample	381
N id_ecd	1149
Observations	4642
Marginal R2 / Conditional R2	0.205 / 0.513

In the first row of the detailed table, the Intercept represents the Total ELOM 4&5 Score when the predictors are all set at 0 (continuous predictors), and when the dichotomous predictors are set to the reference category (e.g., boys, in the case of sex). The intercept does not have a meaning as a score on the ELOM 4&5 in this analysis (indeed, it is an impossible score), and can be ignored. In our model, a boy child from quintile 1 who is severely stunted and has the same score on the continuous predictors as the mean of the sample (e.g., age = 54.74 months, social-emotional combined score = 19.09) could have a score in the range of approximately 31 to 54 on the ELOM 4&5 Total, depending on the sample cluster they are in.

The following rows of the table contain raw and standardised coefficient estimates for each of the predictors in the model, along with confidence intervals, and p-values of the tests that the coefficients = 0. In this case, the p-values are not of particular interest to us given the large sample size – when sample sizes are very large, p-values are more likely to be very small, and an over-reliance on these results can lead to claiming support for results which in fact are of little practical significance.

The standardised Beta coefficients (std. Beta), which are more interesting, have been standardised so that the units of each predictor are on the same scale and they are therefore comparable. They estimate the amount of change in Total ELOM 4&5 Score in SD units by dividing each numeric variable by twice its SD.

The two figures immediately below illustrate the effects graphically, showing their unstandardised sizes in the first of the figures, and the standardised effects in the second. Note that confidence intervals are shown, as well as the line of null effect (0), to give a sense of the uncertainty in the estimates.

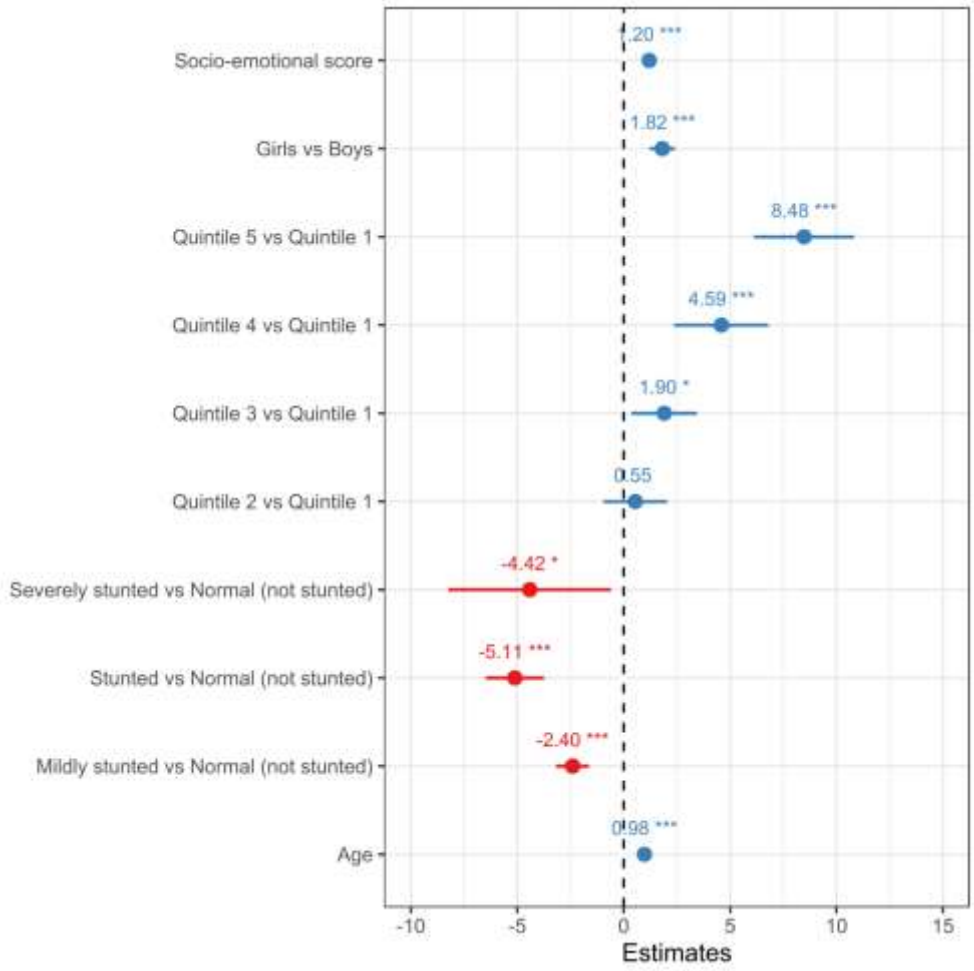


Figure 26: *Effects in the model of Total ELOM 4&5 Score: unstandardised*

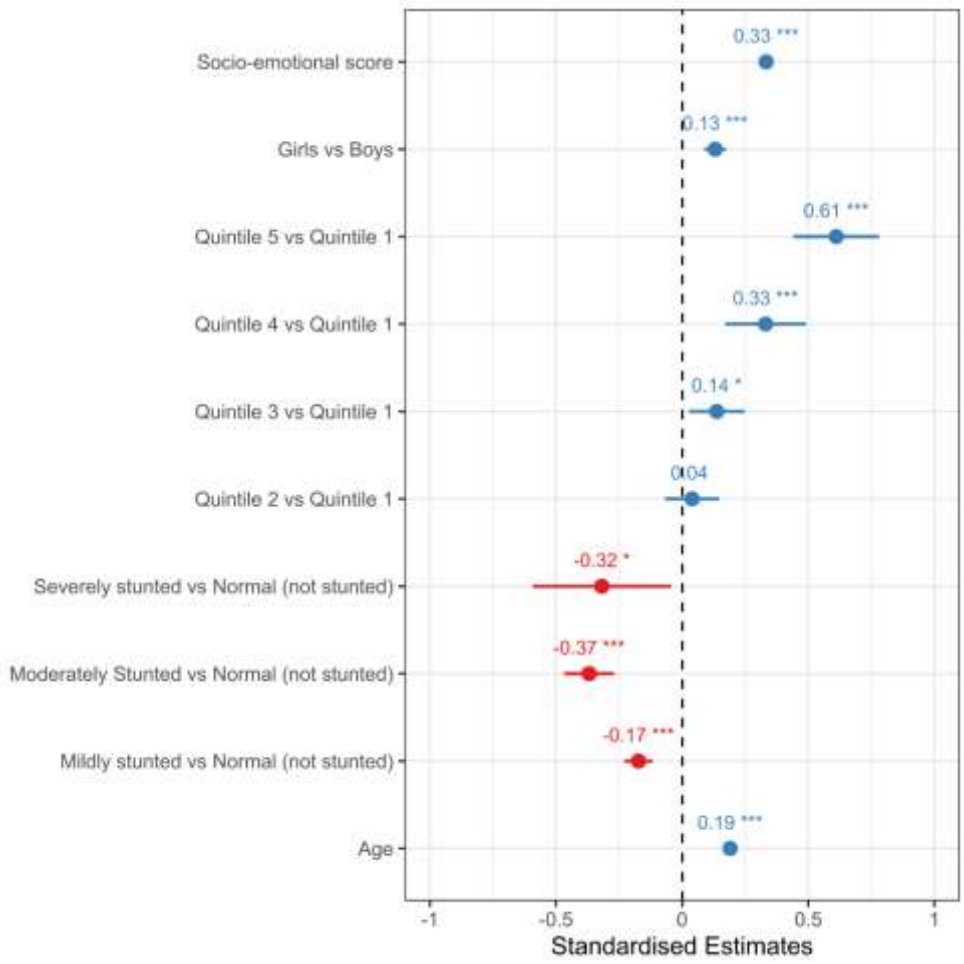


Figure 27: *Effects in the model of Total ELOM 4&5 Score: standardised*

The coefficients in the standardised model correspond to standard-deviation changes of each numeric predictor, or the difference between the two conditions for binary (dummy) predictors.

The size of standardised coefficients allows us to determine the relative importance of predictor variables on the outcome variable. That is, the size of the predictor coefficient is an indication of the effect that that predictor has on the total ELOM 4&5 Score. However, comparisons of these should still be undertaken cautiously, and the confidence intervals reported in the coefficient table can help in judging relative size.

We find that moderate growth stunting has a strong impact on the Total ELOM 4&5 Score (std. β = -0.37), i.e., the greatest difference in Total ELOM 4&5 Scores will be found between children who are moderately stunted and those with no stunting (there is a similar difference between those severely stunted and those with no stunting, but the cell size is small, and the estimate of effect less reliable). The difference between mildly stunted children and those with no stunting is smaller, but is still significant, and underscores the importance of considering this group, who might in some classification systems not be considered stunted (std. β = -0.17).

Socio-economic status (measured in our sample by quintile (natemis) score) also has a strong effect on the Total ELOM 4&5 Score. Differences vary by quintile, but one can see stark differences between children in lower and upper quintiles, particularly between children in quintile 1 and those in quintile 5 (std. β = 0.61) and between children in quintile 1 and those in quintile 4 (std. β = 0.33).

Socio-emotional development has a surprisingly large effect on Total ELOM 4&5 Scores (std. β = 0.33). This is followed in strength by the effects for age, and finally sex. Note that the confidence intervals give a sense of the uncertainty in the estimates and show that there is some degree of overlap in the coefficients for socio-economic status categories, as well as growth status categories.

The marginal R-squared statistic represents the amount of shared variance explained only by fixed effects in the model and provides a measure of how well the fixed effects model fits the actual data. R^2 = 0.21**,** thus 21% of the variance in Total ELOM 4&5 Scores is explained by the variance in growth status, socio-economic status, sex, age and socio-emotional development. Conditional R^2 estimates the variance explained by the entire model, i.e., with both fixed effects and random effects, and in this model, conditional R^2 = 0.51.

To demonstrate what the estimates of the model coefficients mean in practical terms, we consider three example children, and use the model to predict what their ELOM 4&5 performance would be. We consider a girl child from quintile 5, of 59 months of age, with normal growth status, and who has a social-emotional score of 24 (the 90th percentile). We contrast her against a boy from quintile 3, of 50 months of age, who is stunted, and who has a social-emotional score of 19.5 (the 50th percentile), and a boy from quintile 1, of 50 months of age, who is severely stunted, and who has a social-emotional score of 14 (the 10th percentile). These cases are intended to be very different from each other, but of course are not at all exhaustive of the data; they are just for demonstration purposes (and results will in addition depend on the clusters children were sampled in). The figure below shows these predictions, with associated 95% prediction intervals.

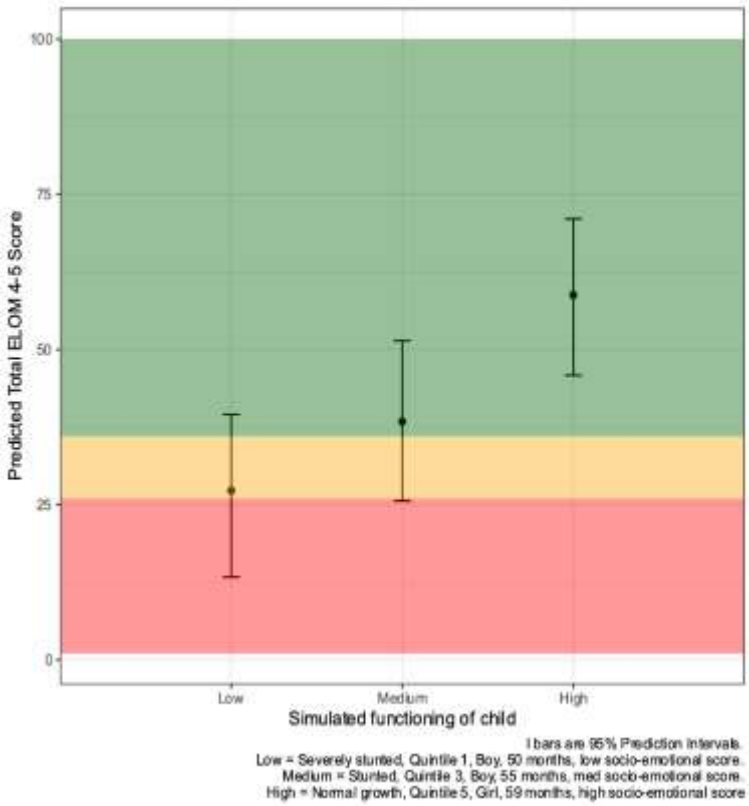


Figure 28: *Predictions for three simulated children*

Although the point predictions for the three cases are quite clearly different, there is a lot of uncertainty in the predictions. This is not surprising if one considers the large amount of variation within categories that we have drawn attention to in several places in the report. Simply put, there is a lot that we don't understand about the determinants of performance on the ELOM 4&5.

7. Provincial summaries

7.1. Eastern Cape

Table 27: Provincial summary

Sample	587 children
	284 (48%) boys and 303 (52%) girls
	Children were drawn from 145 ELPs across 44 sample clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 219 (37.3%) Quintile 2 n = 184 (31.3%) Quintile 3 n = 160 (27.3%) Quintile 4 n = 11 (1.9%) Quintile 5 n = 13 (2.2%)
Social-Emotional Functioning	27.4% of children don't achieve the expected score for social relations with Peers and Adults 37.9% of children don't achieve the expected score for Emotional Readiness for School
Stunting	9.98% of children have stunted growth (9.24% moderately stunted and 0.74% severely stunted)
ELOM Total Score (details below)	Overall, 38.1% of children are *On Track*, 28.5% are *Falling Behind* and 33.4% are *Falling Far Behind* the expected standard for Early Learning
Summary	The Eastern Cape shows some promising results in GMD and emerging literacy and language. However, significant numbers of children perform poorly in the FMC-VMI and ENM domains in particular (especially in the case of boys).

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 28: *Eastern Cape: Descriptive statistics for ELOM 4&5 Total Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	43.18	13.92	0.80	41.42	25.92	61.99	587
Boys	41.95	13.37	1.13	40.23	25.86	60.97	284
Girls	44.26	14.31	0.91	44.09	25.96	63.25	303

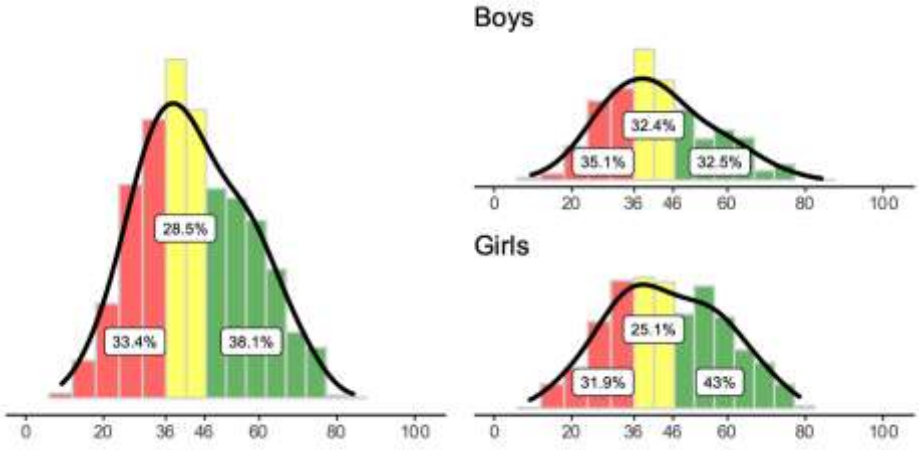


Figure 29: *Eastern Cape: Frequency distributions, with density curves overlaid, for ELOM 4&5 Total Score, separated by sex*

Table 28 shows that at the provincial level:

- Children in the Eastern Cape achieved a mean ELOM 4&5 Total Score of 43.18 (SD = 13.92).
- Girls outperform boys with mean ELOM 4&5 Total Scores of 44.26 (SD = 14.31) and 41.95 (SD = 13.37) respectively.

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. The figure shows:

- Only 38.1% achieve the standard, while 33.4% are *Falling Far Behind*.
- On average, more girls are *On Track* than boys (43% versus 32.5%); 35.1% of boys are *Falling Far Behind*.

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.1.1. Gross Motor Development

Table 29: *Eastern Cape: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.85	3.92	0.24	8.67	3.91	14.44	587
Boys	8.88	3.92	0.25	8.67	3.58	14.44	284
Girls	8.83	3.93	0.32	8.72	3.91	13.70	303

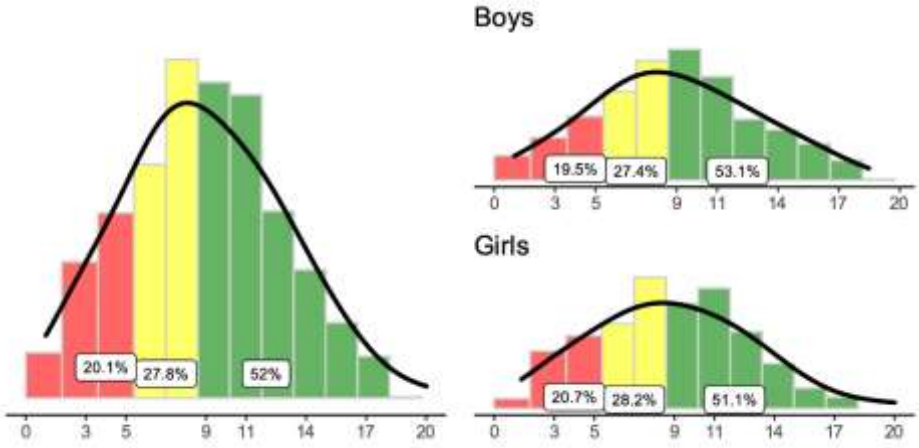


Figure 30: *Eastern Cape: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

Scores for this domain are fairly evenly distributed across the sample. **Table 29** and **Figure 30** show that:

- On average, children in the Eastern Cape achieved a mean GMD score of 8.85 (SD = 3.92).
- This is the most promising domain for children in the Eastern Cape, with 52% of children *On Track*.
- 53.1% of boys and 51.1% of girls are *On Track*, 27.4% and 28.2% are *Falling Behind* and a further 19.5% and 20.7% are *Falling Far Behind*, respectively.

7.1.2. Fine Motor Coordination and Visual Motor Integration

Table 30: *Eastern Cape: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.84	3.52	0.23	10.73	6.23	16.14	587
Boys	10.57	3.53	0.37	10.60	6.52	15.85	284
Girls	11.07	3.51	0.24	10.83	5.86	16.41	303

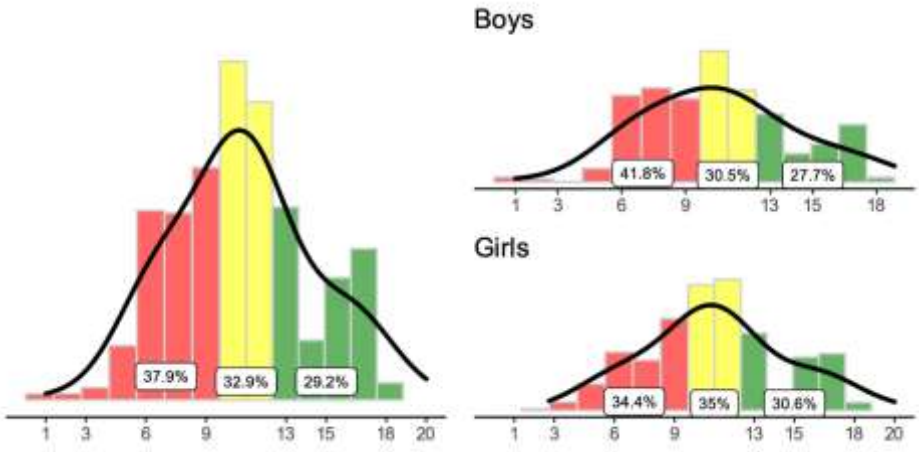


Figure 31: *Eastern Cape: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

- The average score for this domain is relatively high at 10.84, with a small SD of 3.52 (see **Table 30)**.
- However, the figure shows that across the sample, only 29.2% of children are *On Track*.
- Of concern is that 41.8% of boys in the Eastern Cape are *Falling Far Behind* the standard for this domain, as are 34.4% of girls.

7.1.3. Emergent Numeracy and Mathematics

Table 31: *Eastern Cape: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.31	3.69	0.21	6.64	2.38	12.15	587
Boys	6.95	3.51	0.26	6.50	2.38	10.85	284
Girls	7.62	3.81	0.32	6.84	2.38	13.57	303

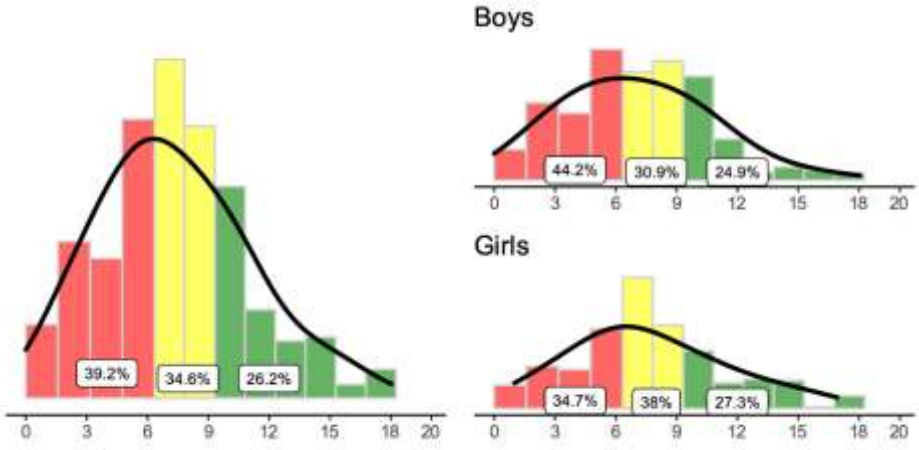


Figure 32: *Eastern Cape: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

These scores approximate a normal although slightly skewed distribution, with more children achieving lower scores than higher scores, and with few being *On Track*.

- **Table 31** shows that, on average, children scored only 7.31 (SD = 3.69).
- Across the sample, only 26.2% of children are *On Track* in this domain.
- Even more concerning is that 39.2% of children are *Falling Far Behind* (44.2% of boys and 34.7% of girls).

7.1.4. Cognition and Executive Functioning

Table 32: *Eastern Cape: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	6.09	3.91	0.24	5.71	1	11.94	587
Boys	5.74	3.79	0.42	5.03	1	11.09	284
Girls	6.39	4.00	0.27	6.29	1	12.61	303

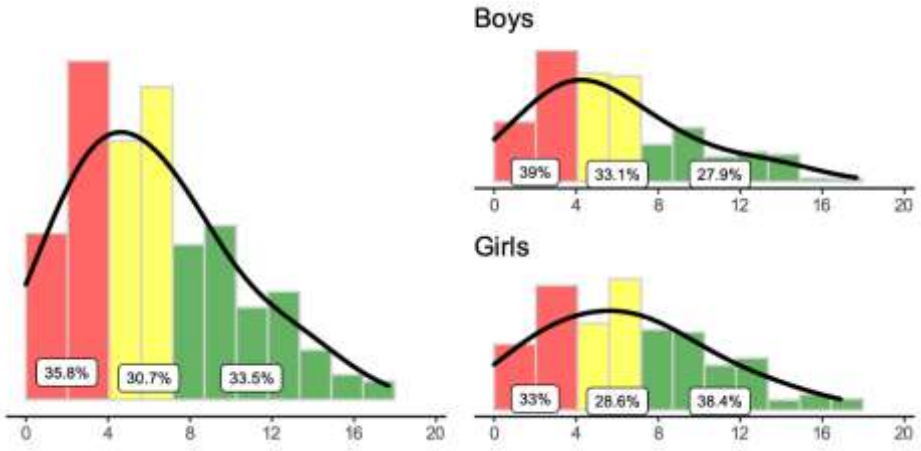


Figure 33: *Eastern Cape: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

Children in the Eastern Cape performed quite poorly in this domain.

- Children scored 6.09 (SD = 3.91) on average. Such a large standard deviation in relation to the mean indicates a huge amount of variation in the scores.
- Across the province, only 33.5% of children are *On Track*, while 30.7% are *Falling Behind* and 35.8% are *Falling Far Behind*.
- 38.4% of girls are *On Track*, with 33% *Falling Far Behind*, while only 27.9% of boys are *On Track* and 39% are *Falling Far Behind*.

7.1.5. Emergent Literacy and Language

Table 33: *Eastern Cape: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.09	3.93	0.26	9.78	4.87	15.31	587
Boys	9.80	3.79	0.33	9.70	4.87	15.07	284
Girls	10.34	4.04	0.34	10.47	5.59	16.06	303

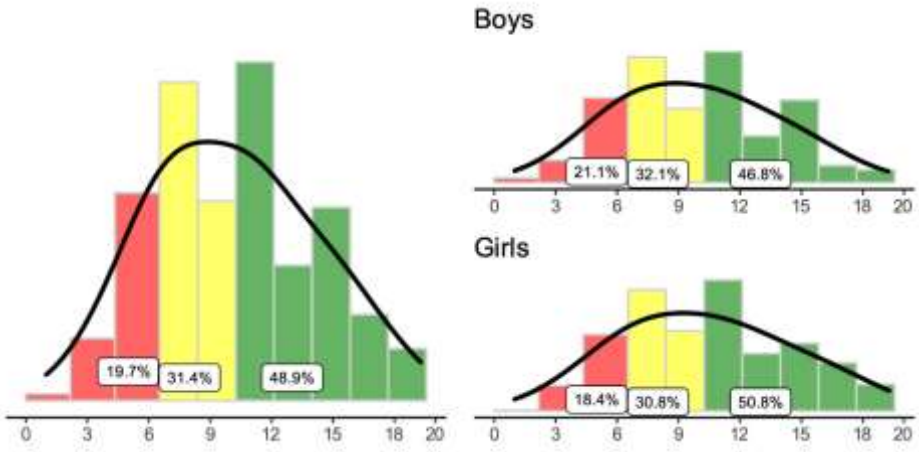


Figure 34: *Eastern Cape: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

ELL scores are more promising. The distribution of scores approximates a normal distribution:

- Children in the Eastern Cape achieved on average 10.09 (SD = 3.93).
- The majority (48.9%) of children are *On Track* for achieving the expected standard, while 31.4% are *Falling Behind* and 19.7% are *Falling Far Behind*.
- There is less difference between sexes for this domain, with 50.8% of girls *On Track* compared with 46.8% of boys.

7.2. Free State

Table 34: Provincial summary

Sample	565 children
	277 (48%) boys and 298 (52%) girls
	Children were drawn from 135 ELPs across 42 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 244 (42.4%) Quintile 2 n = 113 (19.6%) Quintile 3 n = 132 (22.9%) Quintile 4 n = 37 (6.4%) Quintile 5 n = 50 (8.7%)
Social-Emotional Functioning	21.5% of children don't achieve the expected score for Social Relations with Peers and Adults 23.3% of children don't achieve the expected score for Emotional Readiness for School
Stunting	7.9% of children have stunted growth, (6.98% moderately stunted and 0.9% severely stunted)
ELOM Total Score (details below)	Overall, 31.8% of children are *On Track*, 26.7% are *Falling Behind* and 41.5% are *Falling Far Behind* the expected standard for Early Learning
Summary	The results of the Free State are concerning. While children perform best on ELL, much attention should be paid to Free State children's development in FMC-VMI and ENM, and even more so to boys' development in these domains.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 35: *Free State: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	40.08	13.83	1.11	38.64	23.47	58.93	565
Boys	38.66	13.65	1.05	36.80	23.34	57.91	273
Girls	41.50	13.89	1.34	40.90	25.04	60.26	292

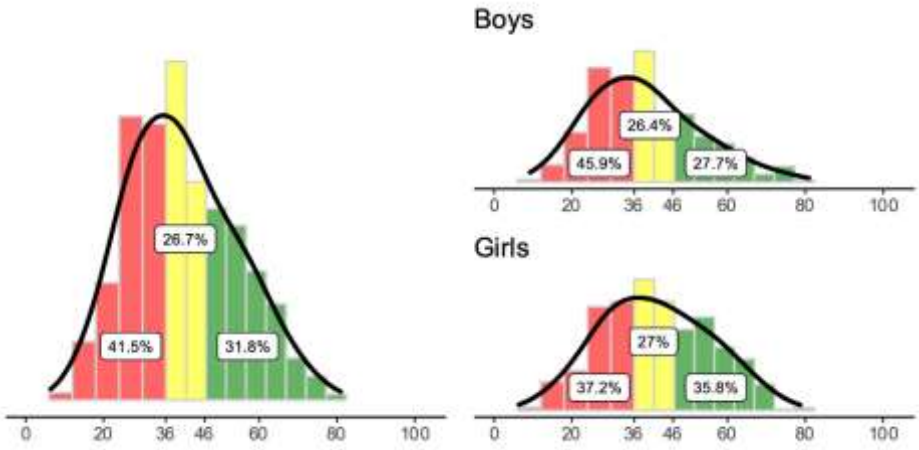


Figure 35: *Free State: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 35 shows:

- Children in the Free State achieved a mean ELOM 4&5 Total Score of 40.08 (SD = 13.83).
- Boys and girls scored similarly, with mean ELOM 4&5 Total Scores of 38.66 (SD = 13.65) and 41.50 (SD = 13.89) respectively (Cohen's $d = 0.21$, indicating a small effect).

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. The figure shows:

- Only 31.8% of children achieve the standard, while 41.5% are *Falling Far Behind*.
- On average, more girls are *On Track* for school than boys (35.8% versus 27.7%), while boys are at greater risk of *Falling Far Behind* (45.9% compared with 37.2%).

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.2.1. Gross Motor Development

Table 36: *Free State: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	6.73	3.57	0.23	6.13	2.36	11.45	565
Boys	6.68	3.58	0.26	6.13	2.36	11.45	273
Girls	6.77	3.56	0.29	6.13	2.36	11.45	292

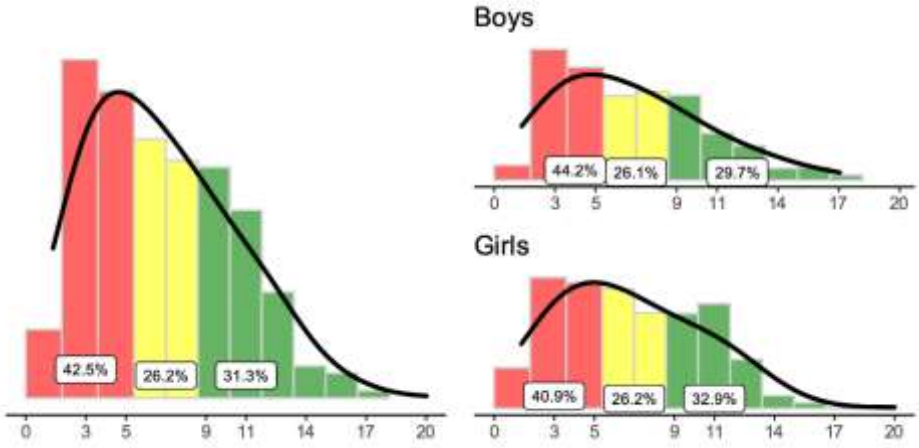


Figure 36: *Free State: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

Table 36 shows that on average:

- Children in the Free State scored similarly and achieved a mean GMD score of only 6.73 (SD = 3.57).
- The figure shows that scores for this domain are highly skewed across the sample, with only 31.3% of children *On Track*, 26.2% *Falling Behind* and a further 42.5% *Falling Far Behind*.
- Fewer boys are *On Track* than girls (29.7% compared with 32.9% respectively) and more boys are *Falling Far Behind* than girls (44.2% compared with 40.9%).

7.2.2. Fine Motor Coordination and Visual Motor Integration

Table 37: *Free State: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.02	3.25	0.24	10.00	6.23	14.76	565
Boys	9.60	3.01	0.25	9.64	5.86	13.30	273
Girls	10.44	3.42	0.31	10.72	6.52	15.55	292

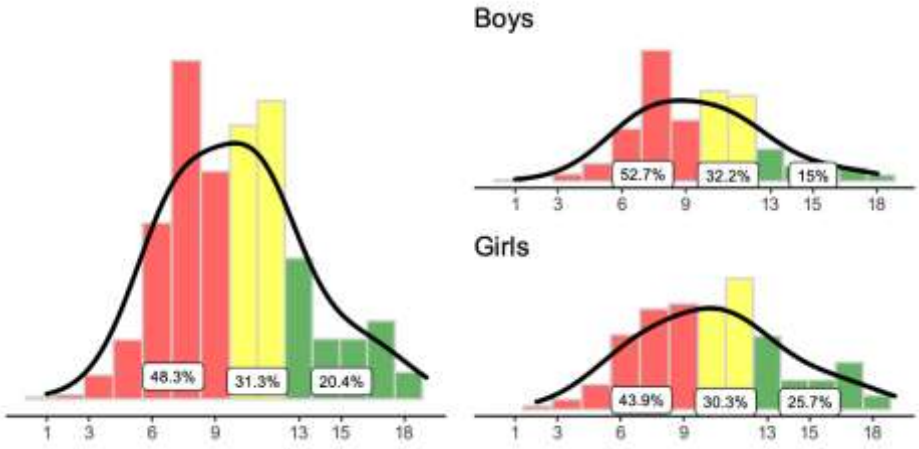


Figure 37: *Free State: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

FMC-VMI scores are concerning:

- The average score for this domain is 10.02, with a relatively small standard deviation of 3.25.
- Of concern is that nearly half the sample is *Falling Far Behind* the domain standards, with only 20.4% of children *On Track*.
- 15% of boys and 25.7% of girls are *On Track*, with a worrying 52.7% of boys *Falling Far Behind*.

7.2.3. Emergent Numeracy and Mathematics

Table 38: *Free State: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.15	3.49	0.24	6.61	2.38	12.15	565
Boys	7.12	3.33	0.24	6.50	2.38	10.92	273
Girls	7.18	3.65	0.32	6.61	2.38	12.27	292

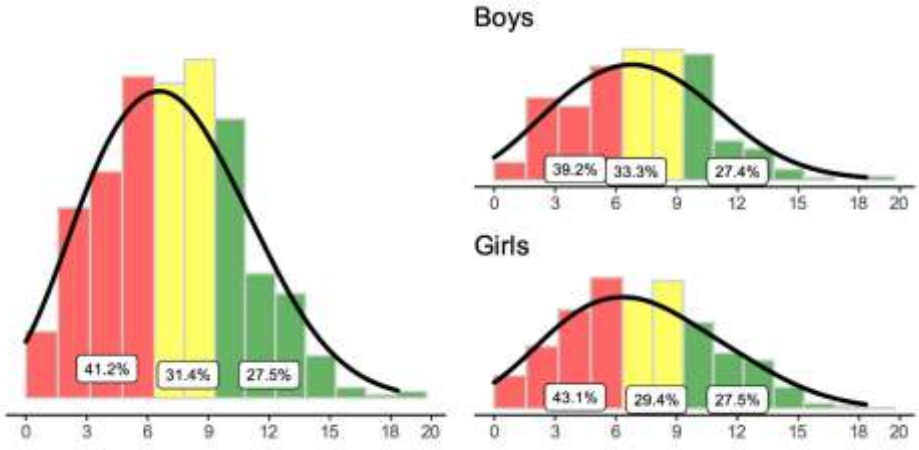


Figure 38: *Free State: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

- On average, children scored 7.15 (SD = 3.49).
- In the total Free State sample, 41.2% of children are *Falling Far Behind*, and only 27.5% are *On Track* for this domain.
- There are no appreciable sex differences of note in this domain.

7.2.4. Cognition and Executive Functioning

Table 39: *Free State: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	6.13	4.10	0.29	5.29	1	12.61	565
Boys	5.82	4.20	0.27	5.13	1	12.84	273
Girls	6.44	3.99	0.39	6.13	1	11.09	292

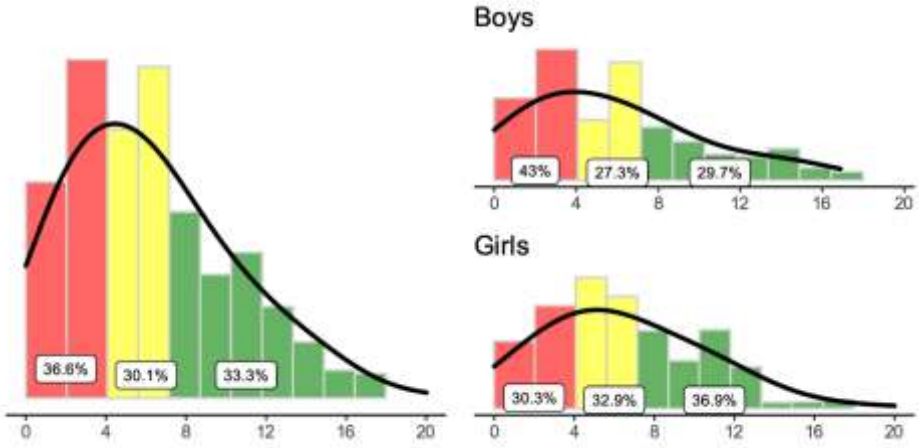


Figure 39: *Free State: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

Children in the Free State achieved low results in this domain:

- Children scored 6.13 on average (SD = 4.10). The large standard deviation per mean score indicates a very large amount of variation in the individual scores.
- Similar proportions of children are *On Track* (33.3%) and *Falling Far Behind* (36.6%).
- Girls and boys score similarly, but a larger proportion of boys (43%) are *Falling Far Behind* the expected standard for this domain compared with 30.3% of girls.

7.2.5. Emergent Literacy and Language

Table 40: *Free State: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	N
Total	10.05	4.87	0.39	9.82	3.72	17.56	565
Boys	9.43	4.63	0.40	8.88	3.40	17.56	273
Girls	10.66	5.04	0.43	10.84	3.72	17.56	292

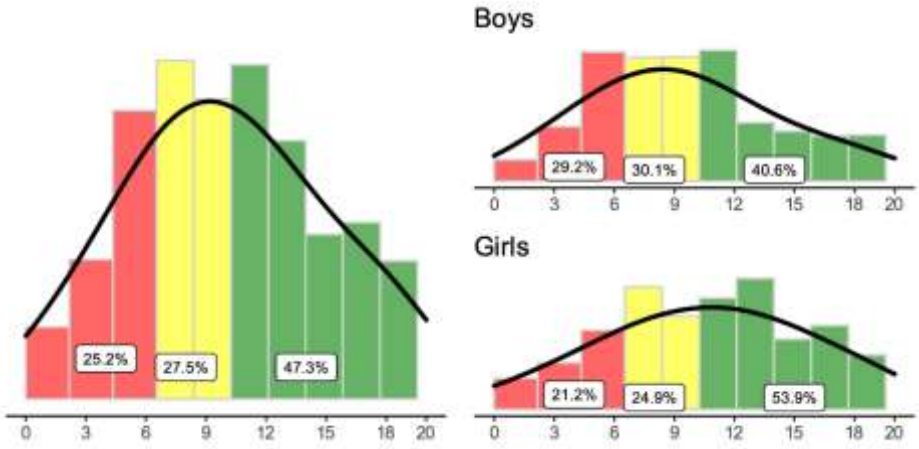


Figure 40: *Free State: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

ELL scores follow a flatter distribution than is seen in other domains, indicating that similar proportions of children achieved scores across the whole range of possible scores. Of the five domains, children in the Free State performed best in this domain:

- Children achieved an average score of 10.05 (SD = 4.87). Note the large variation around the mean.
- It is encouraging that 47.3% of children are *On Track* for achieving the expected standard. Still, 25.2% of children are *Falling Far Behind* the standard.
- 53.9% of girls are *On Track*, compared with 40.6% of boys.

7.3. Northern Cape

Table 41: Provincial summary

Sample	600 children
	275 (46%) boys and 325 (54%) girls
	Children were drawn from 144 ELPs across 48 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 206 (34.3%) Quintile 2 n = 152 (25.3%) Quintile 3 n = 92 (15.3%) Quintile 4 n = 68 (11.3%) Quintile 5 n = 82 (13.7%)
Social-Emotional Functioning	33.5% of children don't achieve the expected score for Social Relations with Peers and Adults 49.7% of children don't achieve the expected score for Emotional Readiness for School
Stunting	6.31% of children have stunted growth, (6.01% moderately stunted and 0.3% severely stunted)
ELOM Total Score (details below)	Overall, 37.2% of children are *On Track*, 25.2% are *Falling Behind* and 37.6% are *Falling Far Behind* the expected standard for Early Learning
Summary	The Northern Cape shows some promising results in the GMD domain. However, children are underperforming significantly in the FMC-VMI domain. ENM and CEF are also of concern, with only slightly better results in emergent literacy.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 42: *Northern Cape: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	41.51	14.41	1.48	39.72	23.67	60.17	600
Boys	40.07	14.59	1.77	38.83	21.84	58.18	275
Girls	42.79	14.16	1.37	43.79	24.05	61.86	325

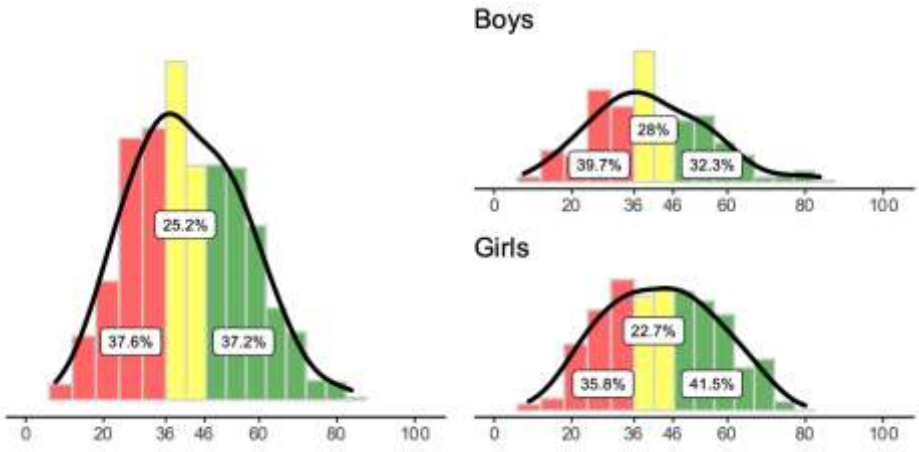


Figure 41: *Northern Cape: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 42 shows that at the provincial level:

- Children in the Northern Cape achieved a mean ELOM 4&5 Total Score of 41.51 (SD = 14.41).
- Girls score 2 points higher than boys, with mean ELOM 4&5 Total Scores of 42.79 (SD = 14.16) and 40.07 (SD = 14.59) respectively (Cohen's $d = 0.19$, indicating a small effect).

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. **Figure 41** shows:

- A total of 37.2% achieve the standard, while 37.6% are *Falling Far Behind*.
- Girls fare much better than boys, with 41.5% *On Track* to meet the standard, whereas only 32.3% of boys are *On Track*.

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.3.1. Gross Motor Development

Table 43: *Northern Cape: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.20	3.72	0.39	8.16	3.58	12.89	600
Boys	8.24	3.53	0.42	7.68	3.91	12.85	275
Girls	8.16	3.89	0.42	8.67	2.91	12.97	325

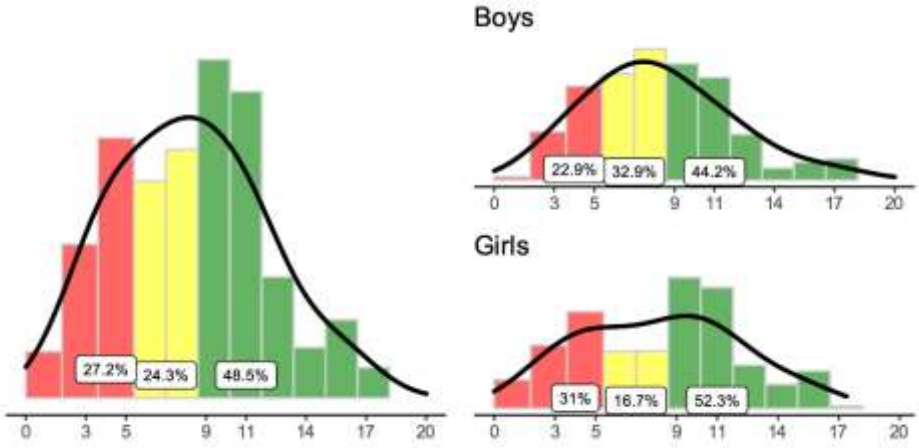


Figure 42: *Northern Cape: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

Of all five domains, children performed the best in GMD.

- On average, children in the Northern Cape achieved a mean GMD score of 8.20 (SD = 3.72).
- Overall, 48.5% of children are *On Track*, 24.3% are *Falling Behind* and 27.2% are *Falling Far Behind*.
- Boys and girls performed similarly. Although more girls are *On Track* than boys (52.3% and 44.2% respectively), still more girls are *Falling Far Behind* than boys (31% and 22.9% respectively).

7.3.2. Fine Motor Coordination and Visual Motor Integration

Table 44: *Northern Cape: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.17	3.76	0.32	10.18	5.86	15.85	600
Boys	9.87	3.88	0.36	10.00	5.86	15.96	275
Girls	10.44	3.63	0.34	10.72	6.23	15.42	325

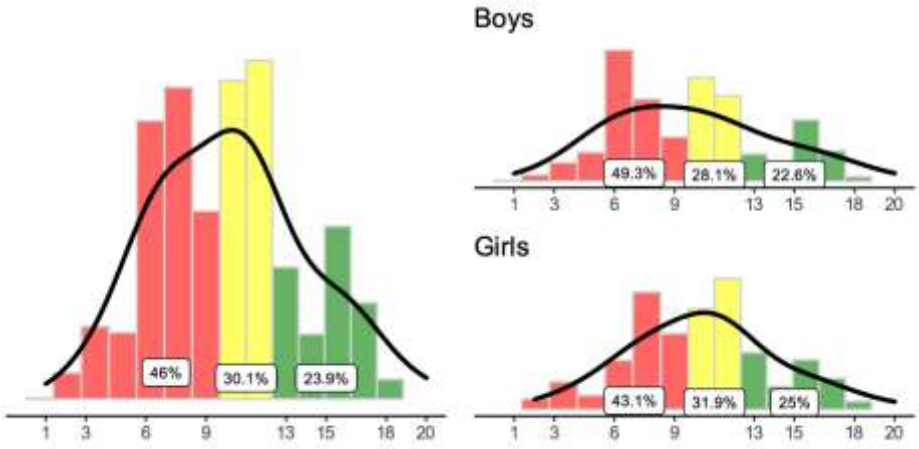


Figure 43: *Northern Cape: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

The figure shows that the scores are unevenly distributed, with clusters of scores comprising those in the *Falling Far Behind* category, those *Falling Behind* and those *On Track* for meeting the expected standard. Northern Cape FMC-VMI scores are somewhat concerning:

- The average score is 10.17 (SD = 3.76). There is little variation in mean scores for the sample.
- Only 23.9% of children are *On Track* and 46% are *Falling Far Behind* in this domain.
- Nearly half of boys (49.3%) in the Northern Cape are *Falling Far Behind* the standard for this domain, as are 43.1% of girls.

7.3.3. Emergent Numeracy and Mathematics

Table 45: *Northern Cape: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.59	3.80	0.31	6.84	2.38	13.46	600
Boys	7.22	3.91	0.41	6.84	2.38	12.43	275
Girls	7.92	3.67	0.30	7.92	4.03	13.57	325

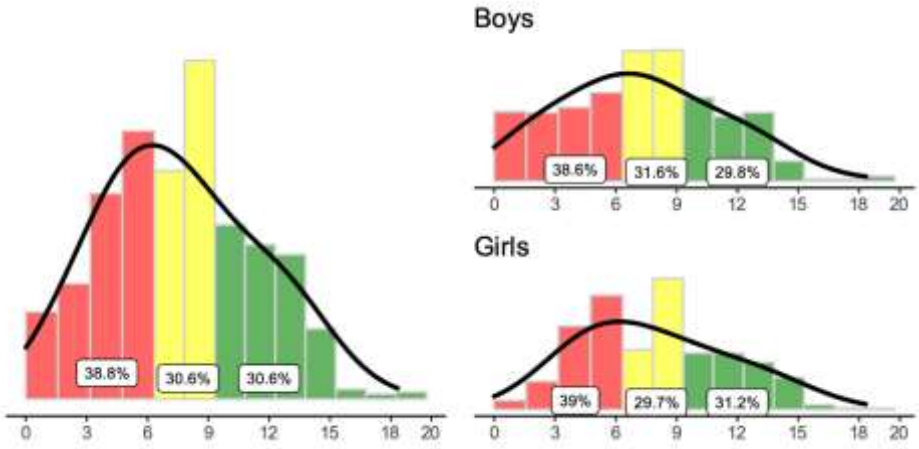


Figure 44: *Northern Cape: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

ENM scores approximate a normal distribution, although a peak can be seen in which a large proportion of children score approximately 9 out of 20 (which places them into the *Falling Behind* category).

- On average, children scored only 7.59 (SD = 3.80).
- Only 30.6% of children are *On Track* in this domain, while 38.8% of children are *Falling Far Behind* the standard.
- There are no appreciable sex differences in this domain.

7.3.4. Cognition and Executive Functioning

Table 46: *Northern Cape: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	6.62	4.08	0.36	6.13	1.26	12.61	600
Boys	6.43	4.31	0.52	5.79	1.00	12.84	275
Girls	6.79	3.86	0.34	6.29	2.26	12.61	325

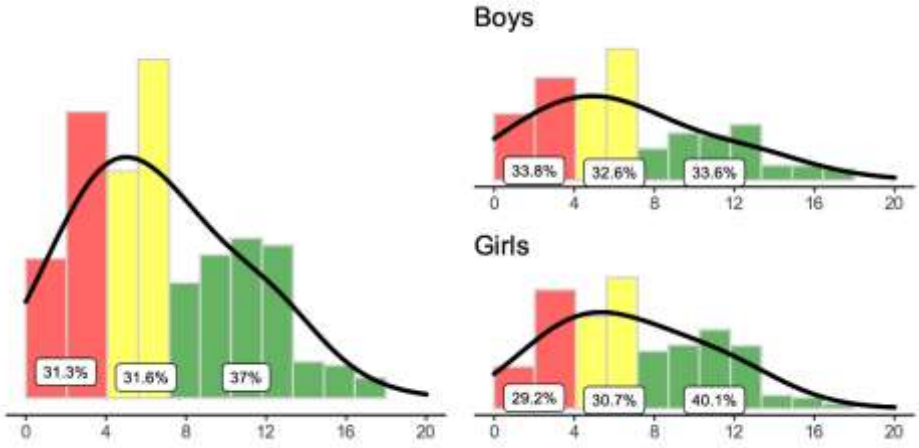


Figure 45: *Northern Cape: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

Children in the Northern Cape performed quite poorly in this domain:

- On average, they scored 6.62 (SD = 4.08). Such a large standard deviation in relation to the mean indicates a large amount of variation in the actual scores.
- There are roughly similar proportions of children in each risk category for this domain. Across the province, 37% of children are *On Track*, while 31.6% are *Falling Behind* and a further 31.3% are *Falling Far Behind*.
- Girls fare somewhat better than boys, with 40.1% *On Track* compared with only 33.6% of boys who are *On Track*.

7.3.5. Emergent Literacy and Language

Table 47: *Northern Cape: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.93	4.62	0.35	8.55	3.09	15.52	600
Boys	8.31	4.30	0.40	7.84	3.19	14.59	275
Girls	9.48	4.82	0.33	10.03	2.64	15.88	325

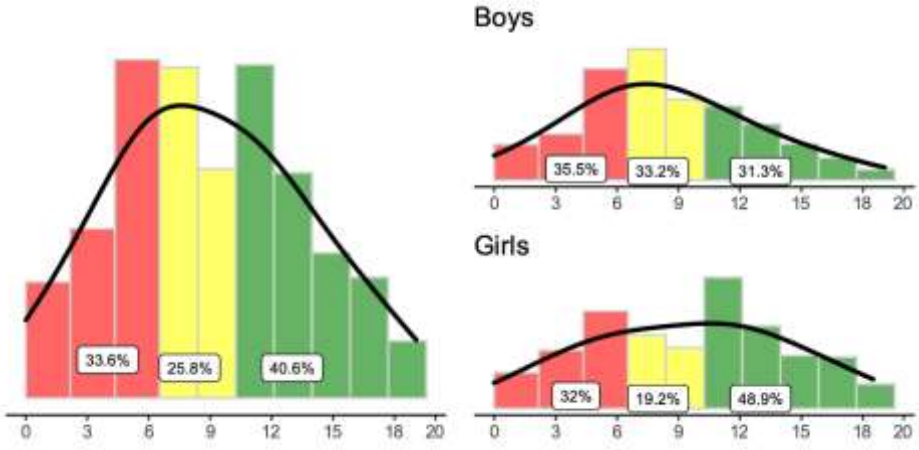


Figure 46: *Northern Cape: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

ELL scores have relatively similar proportions of children achieving very low, average and very high scores.

- On average, children in the Northern Cape scored 8.93 (SD = 4.62) in this domain, with considerable variation in individual scores.
- 40.6% of children are *On Track* for achieving the expected standard, while 25.8% are *Falling Behind* and 33.6% are *Falling Far Behind*.
- Nearly half of girls are *On Track*, while 32% are *Falling Far Behind*, as are 35.5% of boys.

7.4. Mpumalanga

Table 48: Provincial summary

Sample	540 children[75]
	262 (49%) boys and 278 (51%) girls[73]
	Children were drawn from 129 ELPs across 44 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 180 (33.3%) Quintile 2 n = 154 (28.5%) Quintile 3 n = 98 (18.1%) Quintile 4 n = 80 (14.8%) Quintile 5 n = 28 (5.2%)
Social-Emotional Functioning	18.0% of children don't achieve the expected score for Social Relations with Peers and Adults 36.7% of children don't achieve the expected score for Emotional Readiness for School
Stunting	3.3% of children have stunted growth, (2.83% moderately stunted and 0.51% severely stunted)
ELOM Total Score (details below)	Overall, 63.3% of children are *On Track*, 24.5% are *Falling Behind* and 12.2% are *Falling Far Behind* the expected standard for Early Learning
Summary	Overall, the development of more than 60% of children in Mpumalanga is *On Track*. Children perform particularly well in the ELL and CEF domains. Girls tend to perform better than boys. Efforts should be made to address poor performance in FMC-VMI.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

[75] Children for whom weights available, otherwise 588.

Table 49: *Mpumalanga: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	50.81	12.00	1.15	51.31	35.03	66.89	540
Boys	49.22	12.17	1.27	48.17	34.30	67.13	262
Girls	52.35	11.65	1.16	53.42	35.96	66.11	278

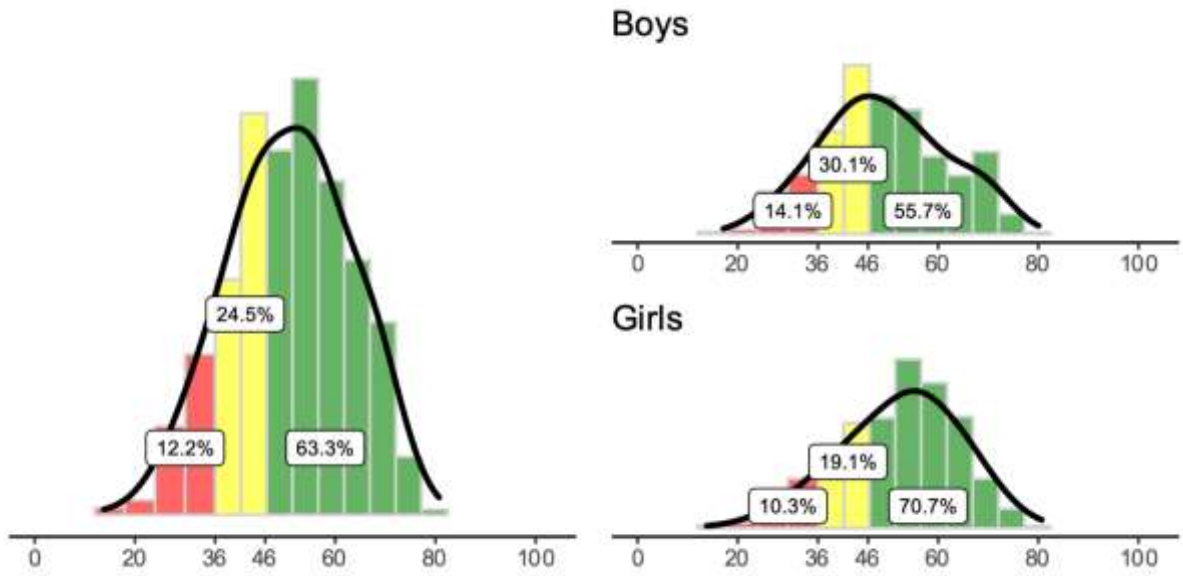


Figure 47: *Mpumalanga: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 49 shows that at the provincial level:

- The mean Total ELOM 4&5 Score is 50.81 (SD =12.0).
- Girls perform somewhat better than boys, with mean scores of 52.35 (SD = 11.65) and 49.22 (SD = 12.17) respectively. This 3-point difference is small but notable (Cohen's $d = 0.26$).

ELOM 4&5 Total Scores are approximately normally distributed. However, differences exist between the proportions of children who are *On Track* (for achieving the ELOM 4&5 standard), *Falling Behind* and *Falling Far Behind* of not achieving the expected standard prior to school, as can be seen in **Figure 47**

- A promising 63.3% of children's development is *On Track*, while 24.5% are *Falling Behind* and only 12.2% are *Falling Far Behind* the standard.

- Overall, a much greater proportion of girls are *On Track* (70.7%), with only 10.3% *Falling Far Behind*; 55.7% of boys are *On Track* and 14.1% are *Falling Far Behind*.

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.4.1. Gross Motor Development

Table 50: *Mpumalanga: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.92	3.87	0.23	8.75	3.91	13.90	540
Boys	8.83	3.88	0.30	8.72	3.91	12.97	262
Girls	9.01	3.88	0.23	9.12	3.91	13.90	278

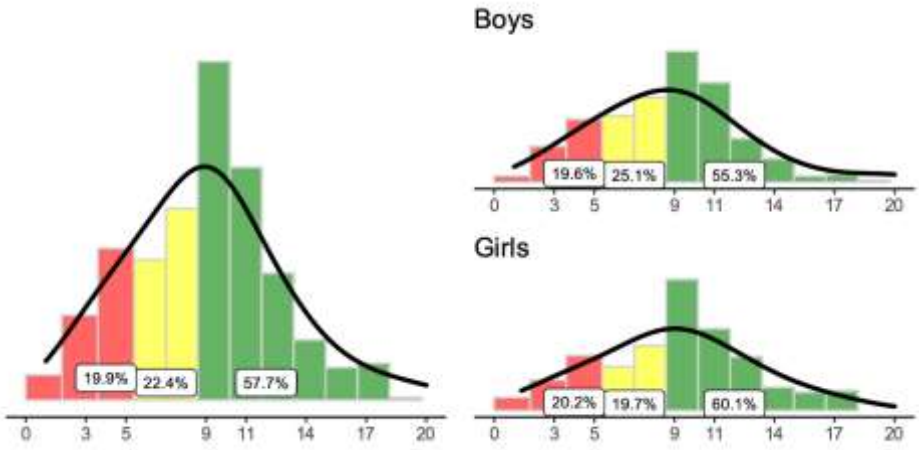


Figure 48: *Mpumalanga: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

The distribution of scores is largely symmetrical and approximates a normal distribution.

- Scores for GMD average 8.92 (SD = 3.87).
- Overall, 57.7% of children are *On Track* in this domain, with 22.4% *Falling Behind* and 19.9% *Falling Far Behind* the expected standard.
- Girls fare slightly better than boys in this domain. The figure shows the score distributions are nearly identical, with 4.8% more girls *On Track* than boys.

7.4.2. Fine Motor Coordination and Visual Motor Integration

Table 51: *Mpumalanga: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	11.90	3.40	0.25	11.38	7.07	16.50	540
Boys	11.30	3.36	0.27	11.27	6.52	16.27	262
Girls	12.48	3.35	0.29	11.69	8.98	17.06	278

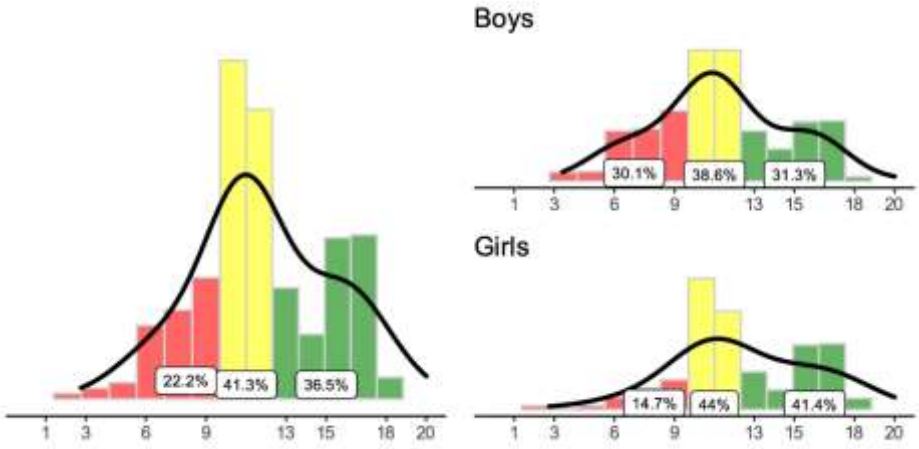


Figure 49: *Mpumalanga: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

- Across the sample, the mean score is 11.90 (SD = 3.40).
- In this domain, most children are *Falling Behind* the standard (41.3%), followed by children who are *On Track* (36.5%), and then those who are *Falling Far Behind* (22.2%).
- There is a dramatic difference in the distribution of the ELOM 4&5 bands between boys and girls, with 41.4% of girls *On Track* and only 14.7% *Falling Far Behind*, while only 31.3% of boys are *On Track* and as many as 30.1% are *Falling Far Behind*.

7.4.3. Emergent Numeracy and Mathematics

Table 52: *Mpumalanga: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	9.76	3.37	0.25	9.68	5.19	13.69	540
Boys	9.33	3.51	0.24	9.31	4.03	13.69	262
Girls	10.19	3.18	0.30	10.65	6.43	13.72	278

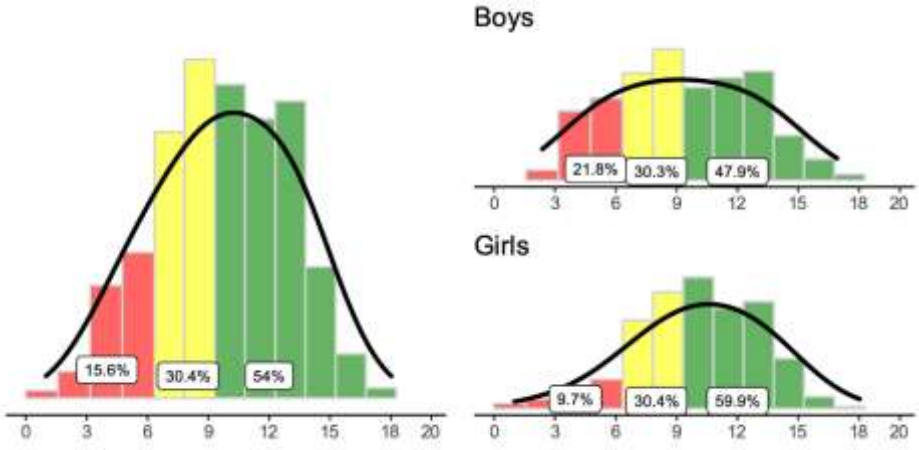


Figure 50: *Mpumalanga: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

ENM scores in Mpumalanga are encouraging:

- The mean score for the whole sample is 9.76 (SD = 3.37).
- Overall, a promising 54% of children are *On Track* to achieve the ENM standard, but 46% do not meet the standard.
- Once again, girls fare much better than boys, with 59.9% *On Track* and only 9.7% *Falling Far Behind*, while 47.9% of boys are *On Track* and 21.8% are *Falling Far Behind*.

7.4.4. Cognition and Executive Functioning

Table 53: *Mpumalanga: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.57	3.57	0.29	8.24	4.37	12.84	540
Boys	8.40	3.72	0.34	8.24	3.37	12.84	262
Girls	8.73	3.41	0.29	8.40	4.37	12.84	278

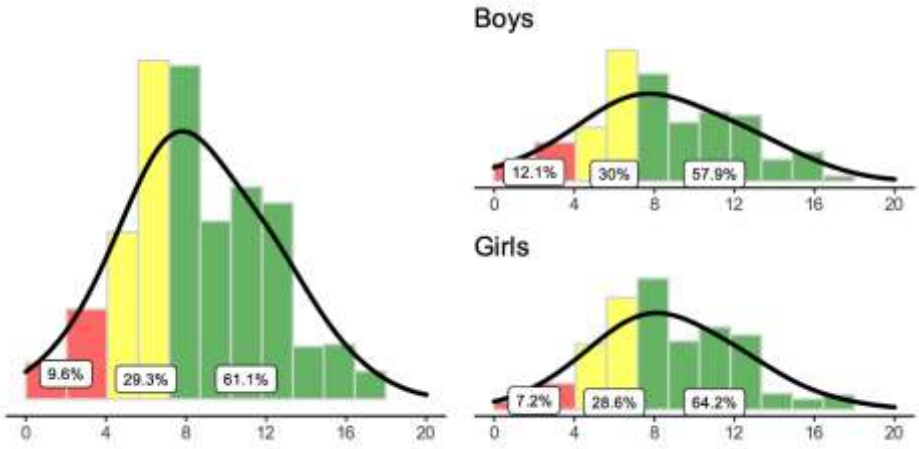


Figure 51: *Mpumalanga: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

- On average, children scored 8.57 (SD = 3.57) out of a possible 20 for CEF tasks.
- Most children (61.1%) are *On Track* for this domain.
- Again, girls outperform boys. While mean differences are negligible, the proportions of children in the different ELOM 4&5 bands vary by sex. A total of 64.2% of girls are *On Track* and only 7.2% are *Falling Far Behind*, while 57.9% of boys are *On Track* and 12.1% are *Falling Far Behind* the expected domain standard.

7.4.5. Emergent Literacy and Language

Table 54: *Mpumalanga: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	11.66	4.26	0.46	12.09	5.91	17.56	540
Boys	11.36	4.28	0.54	11.44	5.59	17.56	262
Girls	11.95	4.24	0.45	12.67	6.36	17.56	278

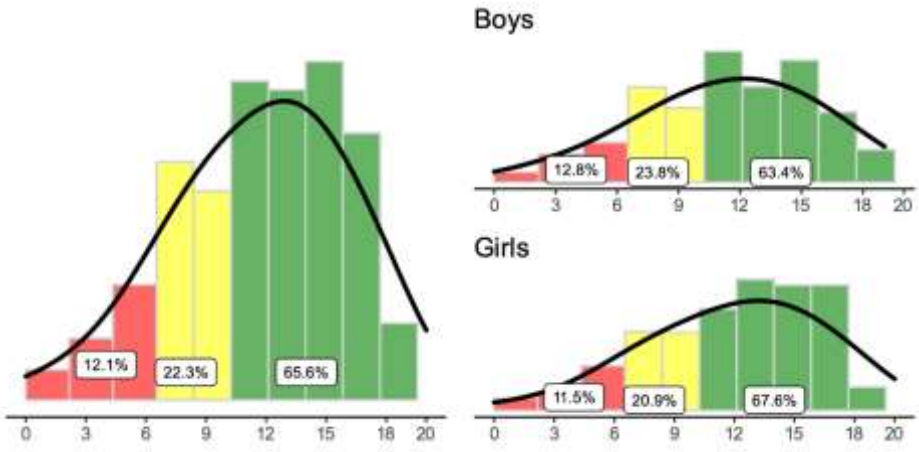


Figure 52: *Mpumalanga: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

- ELL scores are, on average, the highest of the five domains. Across the Mpumalanga sample, the mean score is 11.66 (SD = 4.26).
- Across the board, 65.6% of Mpumalanga children are *On Track* for this domain.
- Boys and girls score similarly, on average – 67.6% of girls and 63.4% of boys are *On Track*, and only 11.5% of girls and 12.8% of boys are *Falling Far Behind*.

7.5. Gauteng

Table 55: Provincial summary

Sample	571 children
	278 (49%) boys and 293 (51%) girls
	Children were drawn from 143 ELPs across 40 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 62 (11%) Quintile 2 n = 72 (12.6%) Quintile 3 n = 164 (28.7%) Quintile 4 n = 122 (21.4%) Quintile 5 n = 151 (26.4%)
Social-Emotional Functioning	50.7% of children don't achieve the expected score for Social Relations with Peers and Adults 34.2% of children don't achieve the expected score for Emotional Readiness for School
Stunting	5.7% of children have stunted growth, (5.19% moderately stunted and 0.48% severely stunted)
ELOM Total Score (details below)	Overall, 50.6% of children are *On Track*, 22.7% are *Falling Behind* and 26.8% are *Falling Far Behind* the expected standard for Early Learning
Summary	The results of Gauteng are mixed. While children perform best on ELL and CEF, performance is weakest in FMC-VMI and ENM, particularly in the case of boys.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 56: *Gauteng: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	45.61	13.97	1.03	46.69	26.82	63.48	571
Boys	44.93	13.43	1.07	45.80	26.85	62.75	278
Girls	46.26	14.45	1.49	47.18	26.72	65.23	293

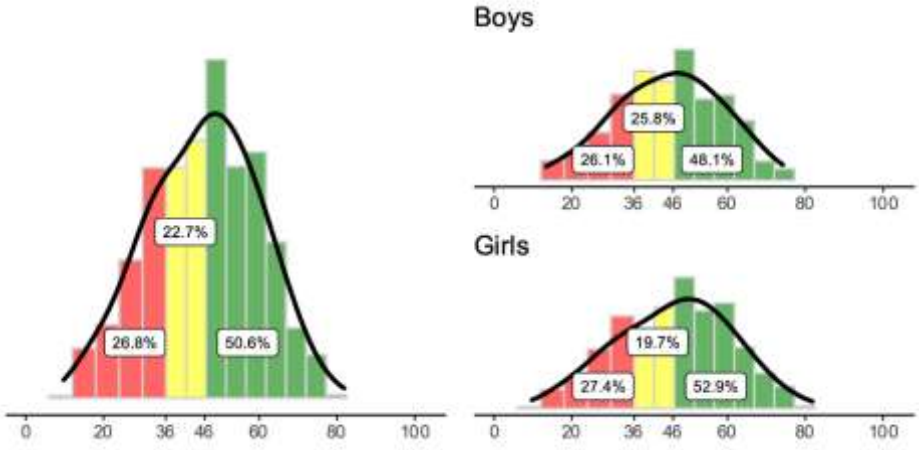


Figure 53: *Gauteng: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

- Children in Gauteng achieved a mean ELOM 4&5 Total Score of 45.61 (SD = 13.97).
- Boys and girls score similarly, with mean ELOM 4&5 Total Scores of 44.93 (SD = 13.43) and 46.26 (SD = 14.45) respectively.

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. The figure shows:

- Across the Gauteng sample, just over half of children are *On Track* to achieve the standard, while 49.5% are not.
- On average, more girls are *On Track* than boys (52.9% versus 48.1%), and an equal proportion (27.4% and 26.1% respectively) are *Falling Far Behind*.

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.5.1. Gross Motor Development

Table 57: *Gauteng: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.53	3.81	0.29	7.57	2.36	12.81	571
Boys	7.73	3.73	0.30	7.68	2.36	12.81	278
Girls	7.34	3.89	0.43	7.20	2.91	12.81	293

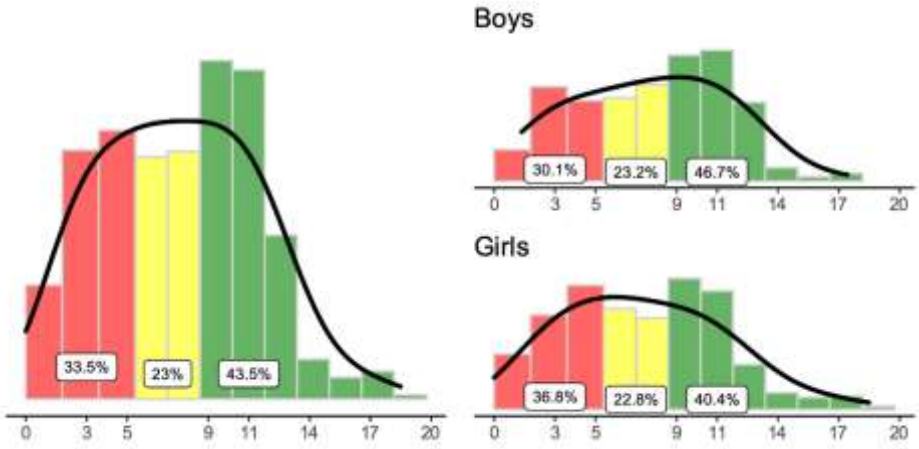


Figure 54: *Gauteng: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

GMD scores follow a more uniform distribution than is seen in other domains, indicating that similar proportions of children achieved scores across the whole range of possible scores. The table shows that on average:

- Children in Gauteng achieved similar scores and attained a mean GMD score of 7.53 (SD = 3.81).
- Overall, 43.5% of children are *On Track*, 23% are *Falling Behind* and a further 33.5% are *Falling Far Behind*.
- Fewer girls in Gauteng are *On Track* than boys (40.4% compared with 46.7% respectively), and more girls are *Falling Far Behind* than boys (36.8% compared with 30.1%).

7.5.2. Fine Motor Coordination and Visual Motor Integration

Table 58: *Gauteng: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	11.40	3.74	0.23	11.27	6.52	16.50	571
Boys	10.94	3.48	0.25	10.73	6.52	15.96	278
Girls	11.84	3.93	0.32	11.38	6.52	16.93	293

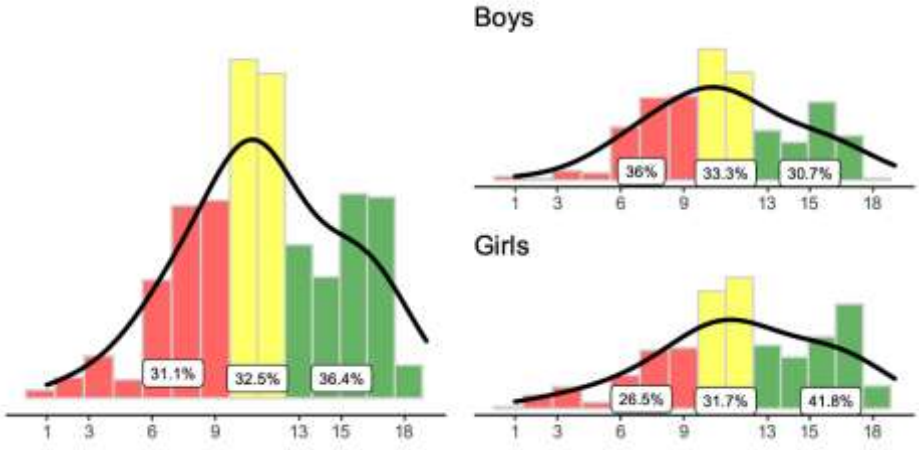


Figure 55: *Gauteng: Frequency distributions, with density curves overlaid, for FMC-VMI, separated by sex*

The distribution of scores approximates a normal distribution but there are large clusters of scores across the range.

- The average score for this domain is 11.40 (SD = 3.74).
- Overall, 36.4% of children are *On Track*, 32.5% are *Falling Behind* and a further 31.1% are *Falling Far Behind*.
- Among girls, 41.8% are *On Track*, while 58.2% are not. Among boys, only 30.7% of boys meet the expected domain standard and 69.3% do not.

7.5.3. Emergent Numeracy and Mathematics

Table 59: *Gauteng: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.11	3.91	0.29	7.92	2.65	13.57	571
Boys	8.04	3.79	0.33	7.92	3.47	13.57	278
Girls	8.18	4.02	0.38	7.93	2.65	13.57	293

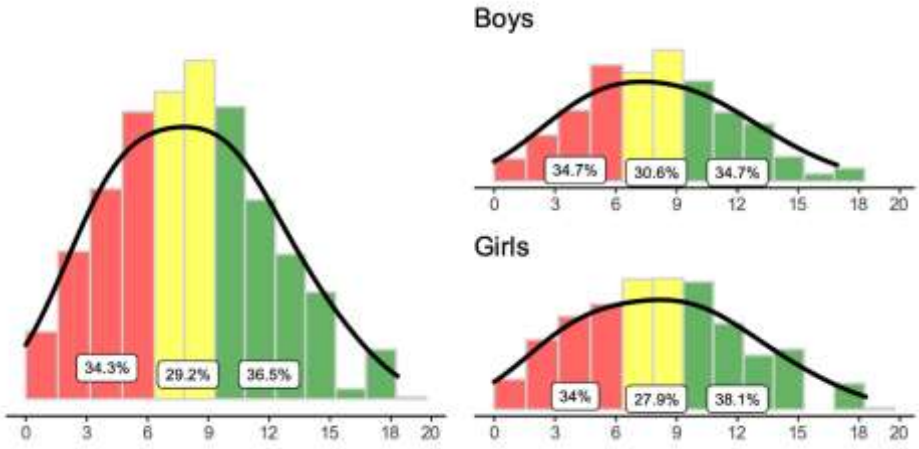


Figure 56: *Gauteng: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

The figure shows that ENM scores approximate a normal distribution.

- On average, children scored 8.11 (SD = 3.91). The large standard deviation relative to the mean score indicates a very large amount of variation in the individual scores for this domain.
- Across the Gauteng sample, 36.5% of children are *On Track* for this domain, while 34.3% are *Falling Far Behind*.
- There are no appreciable sex differences in this domain.

7.5.4. Cognition and Executive Functioning

Table 60: *Gauteng: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.71	3.69	0.23	7.14	3.11	12.61	571
Boys	7.41	3.65	0.24	7.14	2.26	12.42	278
Girls	7.98	3.72	0.33	7.47	3.11	12.84	293

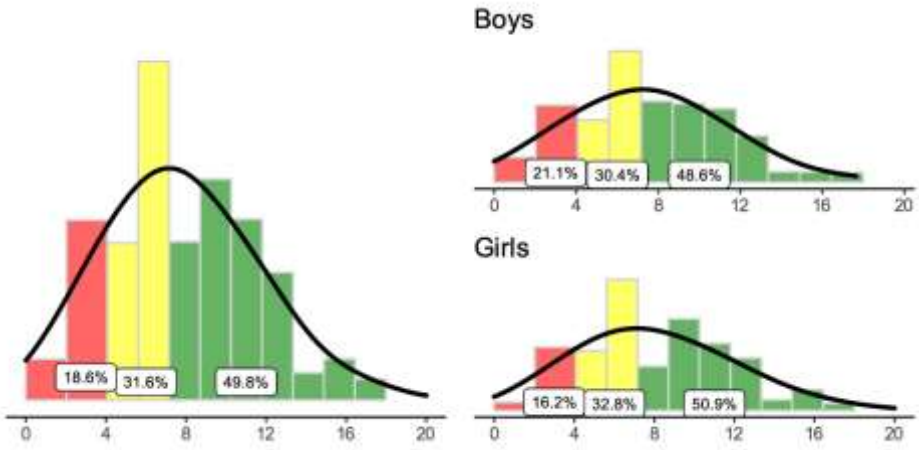


Figure 57: *Gauteng: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

Children in Gauteng produced some promising results in this domain.

- Children scored 7.71 on average (SD = 3.69). The large standard deviation relative to the mean score indicates substantial variation in individual scores.
- Almost half of Gauteng children are *On Track*, while 31.5% are *Falling Behind* and 18.6% are *Falling Far Behind*.
- There are no appreciable sex differences in this domain, although slightly more boys (21.1%) are *Falling Far Behind* the standard than girls (16.2%).

7.5.5. Emergent Literacy and Language

Table 61: *Gauteng: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.86	4.65	0.28	11.17	4.66	16.78	571
Boys	10.80	4.63	0.40	10.93	3.44	16.78	278
Girls	10.91	4.67	0.35	11.25	4.87	16.78	293

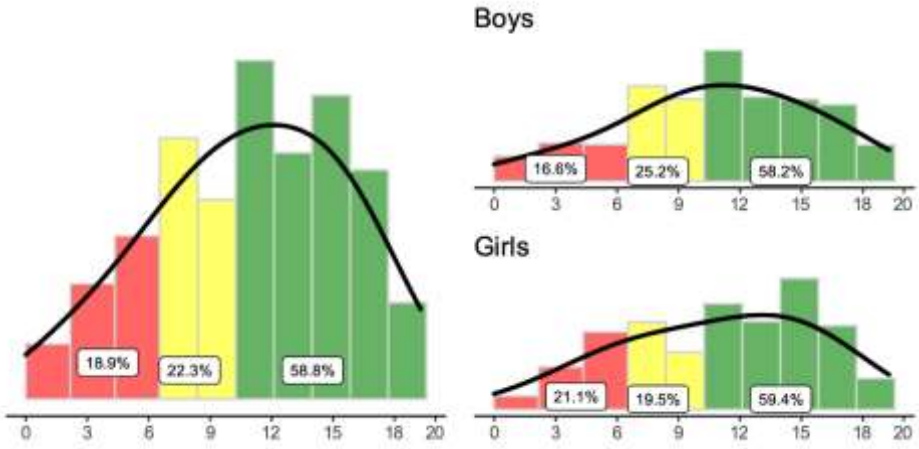


Figure 58: *Gauteng: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

Of the five domains, children in Gauteng performed best in this domain:

- Children achieved an average score of 10.86 (SD = 4.65). Note the large standard deviation indicating considerable variation in children's abilities.
- The majority of children (58.8%) are *On Track* for achieving the expected standard. Still, 22.3% are *Falling Behind* and 18.9% are *Falling Far Behind*.
- Boys and girls perform similarly in this domain.

7.6. North West

Table 62: Provincial summary

Sample	564 children (588 in total, but 24 were missing weighting data)
	273 (48%) boys and 291 (52%) girls
	Children were drawn from 134 ELPs across 38 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 228 (40.4%) Quintile 2 n = 107 (19%) Quintile 3 n = 199 (35.3%) Quintile 4 n = 30 (5.32%) Quintile 5 n = 0 (0%)
Social-Emotional Functioning	32.3% of children don't achieve the expected score for Social Relations with Peers and Adults 46.6% of children don't achieve the expected score for Emotional Readiness for School
Stunting	5.84% of children have stunted growth, (5.71% moderately stunted and 0.13% severely stunted)
ELOM Total Score (details below)	Overall, 44.5% of children are *On Track*, 30% are *Falling Behind* and 25.5% are *Falling Far Behind* the expected standard for Early Learning
Summary	The North West shows some promising results. However, weak performances are evident in the FMC-VMI and ENM domains, with boys consistently at greater risk than girls of not achieving domain standards.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 63: *North West: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	44.84	12.05	0.85	44.65	29.39	62.08	564
Boys	43.81	12.27	1.09	43.99	28.63	61.95	273
Girls	45.84	11.76	1.05	45.15	30.51	62.08	291

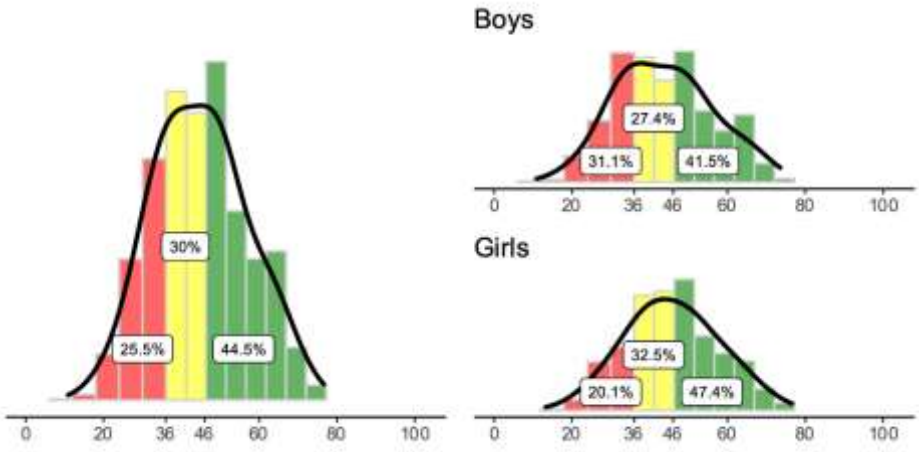


Figure 59: *North West: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 63 shows that:

- Children in North West achieved a mean ELOM 4&5 Total Score of 44.84 (SD = 12.05).
- Boys and girls score similarly, with mean ELOM 4&5 Total Scores of 43.81 (SD = 12.27) and 45.84 (SD = 11.76) respectively.

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. **Figure 59** shows that:

- 44.5% of North West children are *On Track* for the standard, while 25.5% are *Falling Far Behind*.
- On average, more girls are *On Track* than boys (47.4% versus 41.5%), with more boys *Falling Far Behind* the standard (31.1% compared with 20.1% of girls).

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.6.1. Gross Motor Development

Table 64: *North West: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.28	3.62	0.26	8.67	3.43	12.92	564
Boys	8.52	3.86	0.33	8.75	2.91	12.97	273
Girls	8.06	3.37	0.30	8.16	3.58	12.89	291

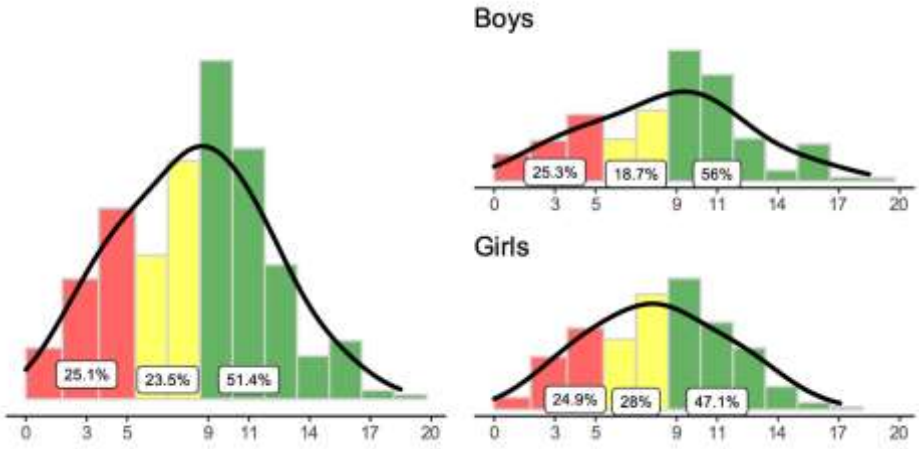


Figure 60: *North West: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

Scores for this domain show little variation across the sample.

- On average, children in North West achieved a mean GMD score of 8.28 (SD = 3.62).
- More than half of children (51.4%) are *On Track*, while 25.1% are *Falling Far Behind*.
- Boys perform better than girls in this domain, with 56% of boys compared with 47.1% of girls *On Track*.

7.6.2. Fine Motor Coordination and Visual Motor Integration

Table 65: *North West: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	11.49	2.93	0.21	10.83	8.26	15.96	564
Boys	11.10	2.80	0.29	10.73	7.62	15.41	273
Girls	11.87	3.01	0.28	11.38	8.98	15.96	291

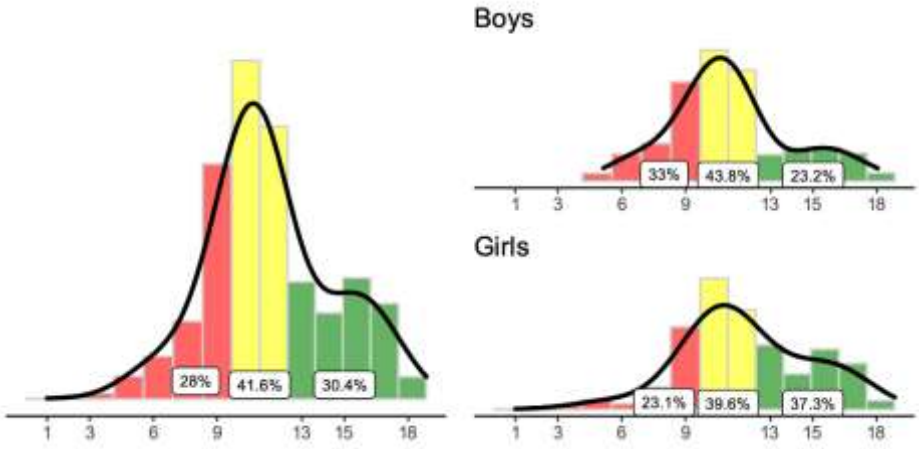


Figure 61: *North West: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

- The average score for this domain is 11.49, with a small standard deviation of 2.93.
- The scores are unevenly distributed, with only 30.4% of North West children *On Track* in this domain, and 28% *Falling Far Behind*.
- Girls perform better than boys in this domain. Only 23.2% of boys in this province are *On Track* for achieving the expected domain standard, compared with 37.3% of girls.

7.6.3. Emergent Numeracy and Mathematics

Table 66: *North West: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.98	3.28	0.16	7.92	4.03	12.27	564
Boys	7.74	3.23	0.25	7.69	2.80	12.15	273
Girls	8.22	3.33	0.23	8.04	4.03	12.46	291

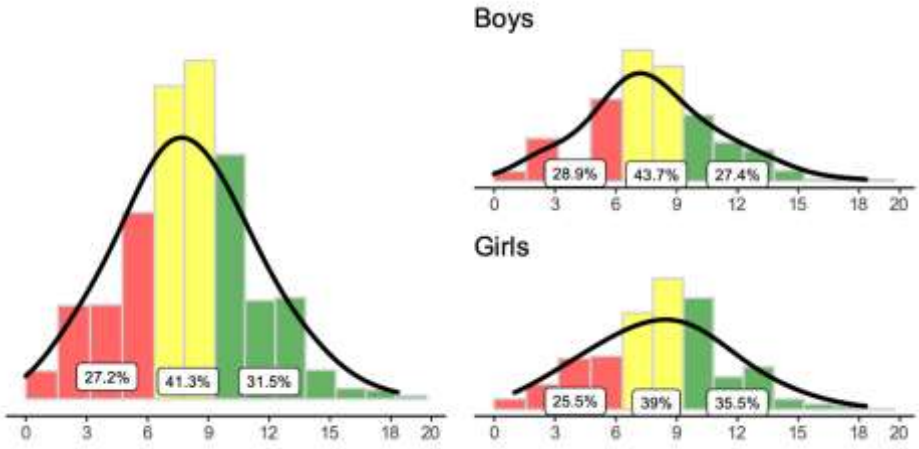


Figure 62: *North West: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

The ENM scores approximate a normal distribution.

- On average, children scored 7.98 (SD = 3.28).
- 31.5% of children are *On Track* for ENM, while 27.2% are *Falling Far Behind*.
- Girls perform better than boys, with only 27.4% of boys *On Track*, compared with 35.5% of girls.

7.6.4. Cognition and Executive Functioning

Table 67: *North West: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	7.03	3.94	0.29	6.48	2.26	12.61	564
Boys	6.71	4.10	0.35	6.13	2.11	12.61	273
Girls	7.33	3.76	0.37	6.71	3.11	12.61	291

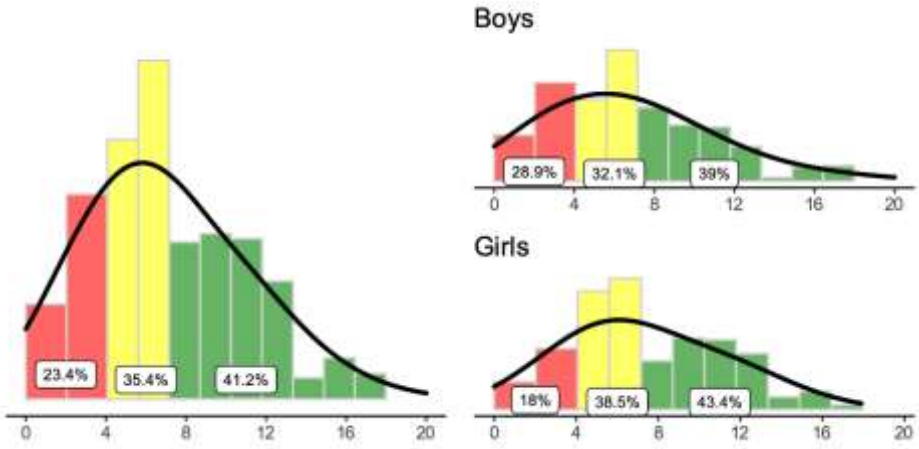


Figure 63: *North West: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

Children in North West province performed relatively well in this domain.

- Children scored 7.03 (SD = 3.94) on average. Such a large standard deviation in relation to the mean indicates a huge amount of variation in the children's scores.
- The figure shows that 41.2% of children across the province are *On Track*, while 35.4% are *Falling Behind* and 23.4% are *Falling Far Behind*.
- On average, boys and girls performed similarly. However, more girls are *On Track* than boys, and fewer girls are *Falling Far Behind* than their male counterparts (18% compared with 28.9%).

7.6.5. Emergent Literacy and Language

Table 68: *North West: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.06	4.05	0.24	10.27	4.87	15.40	564
Boys	9.75	3.83	0.26	10.03	4.87	14.47	273
Girls	10.35	4.23	0.36	10.27	4.87	16.30	291

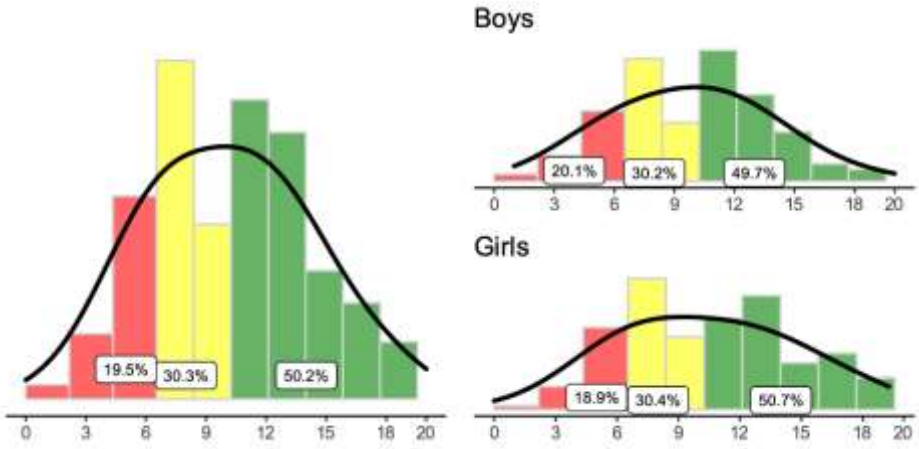


Figure 64: *North West: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

The distribution of ELL scores is more uniform than the other domains. This is the most promising domain for children in North West:

- Children in North West achieved on average 10.06 (SD = 4.05).
- Half of North West children are *On Track* for achieving the expected standard in this domain, while 30.3% are *Falling Behind* and 19.5% are *Falling Far Behind*.
- There is a negligible sex difference in this domain, with roughly half of both boys and girls *On Track*.

7.7. Western Cape

Table 69: Provincial summary

Sample	559 children
	268 (48%) boys and 291 (52%) girls
	Children were drawn from 134 ELPs across 38 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 121 (21.6%) Quintile 2 n = 106 (19%) Quintile 3 n = 77 (13.8%) Quintile 4 n = 104 (18.6%) Quintile 5 n = 151 (27%)
Social-Emotional Functioning	33.1% of children don't achieve the expected score for Social Relations with Peers and Adults 41.1% of children don't achieve the expected score for Emotional Readiness for School
Stunting	5.2% of children have stunted growth, (4.38% moderately stunted and 0.86% severely stunted)
ELOM Total Score (details below)	Overall, 64.8% of children are *On Track*, 19.2% are *Falling Behind* and 16% are *Falling Far Behind* the expected standard for Early Learning
Summary	The Western Cape shows promising results for the Learning Total Score and across domains. Girls generally performed better than boys, with children excelling in the ELL and CEF domains. ENM is an area of concern requiring special attention.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 70: *Western Cape: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	52.40	15.19	1.80	52.42	32.12	72.01	559
Boys	50.55	15.31	1.96	50.75	30.44	68.72	268
Girls	53.99	14.93	1.97	54.61	33.04	72.67	291

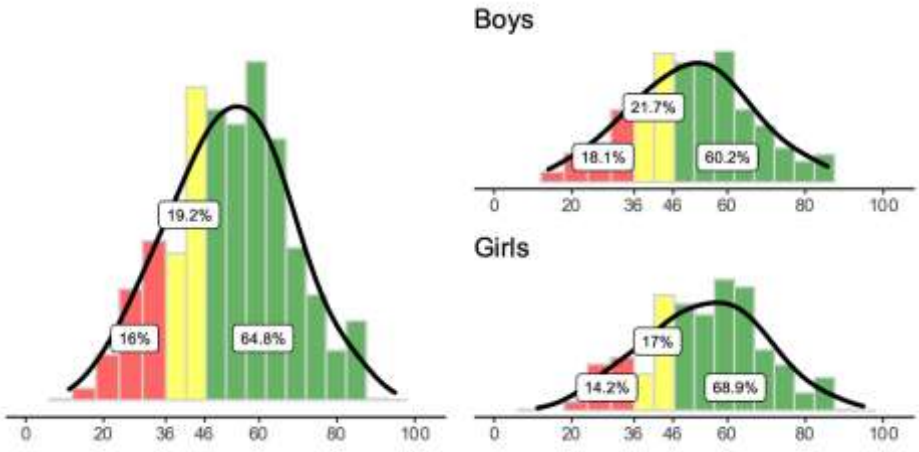


Figure 65: *Western Cape: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 70 shows that in the Western Cape:

- Children achieved a mean ELOM 4&5 Total Score of 52.40 (SD = 15.19).
- Girls scored, on average, 3 points higher than boys, with mean ELOM 4&5 Total Scores of and 53.99 (SD = 14.93) and 50.55 (SD = 15.31) respectively (Cohen's d = 0.23, indicating a small effect).

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. **Figure 65** shows that:

- The majority of Western Cape children (64.8%) achieve the standard and only 16% are *Falling Far Behind*.
- On average, more girls are *On Track* for school than boys (68.9% versus 60.2%).

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.7.1. Gross Motor Development

Table 71: *Western Cape: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.78	4.78	0.33	8.67	2.36	14.44	559
Boys	9.48	4.84	0.46	8.72	3.43	15.87	268
Girls	8.18	4.65	0.41	8.43	2.22	14.44	291

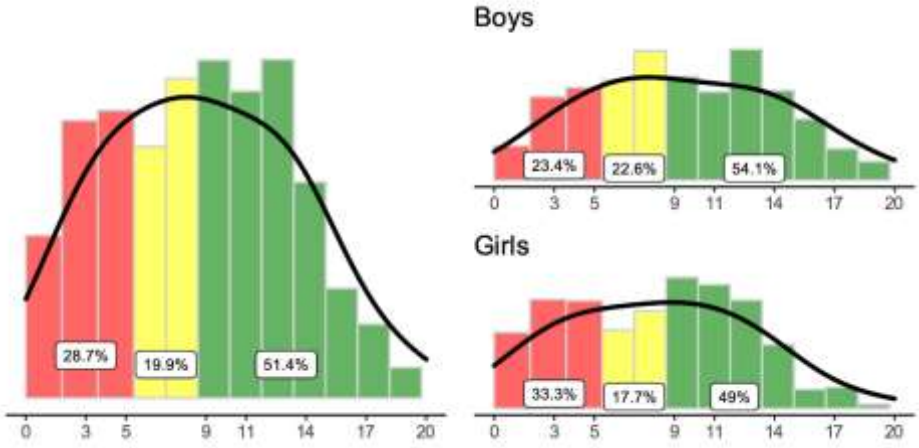


Figure 66: *Western Cape: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

Scores for this domain are evenly distributed across the sample.

- On average, children in the Western Cape achieved a mean GMD score of 8.78 (SD = 4.78).
- 51.4% of children are *On Track*, with 19.9% *Falling Behind* and 28.7% *Falling Far Behind*.
- Boys performed better in this domain than girls: 54.1% of boys and 49% of girls are *On Track*, while 23.4% compared with 33.3% are *Falling Far Behind*, respectively.

7.7.2. Fine Motor Coordination and Visual Motor Integration

Table 72: *Western Cape: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	12.76	3.46	0.40	11.92	8.71	17.47	559
Boys	11.95	3.35	0.38	11.56	7.06	16.93	268
Girls	13.46	3.41	0.47	12.73	9.63	18.03	291

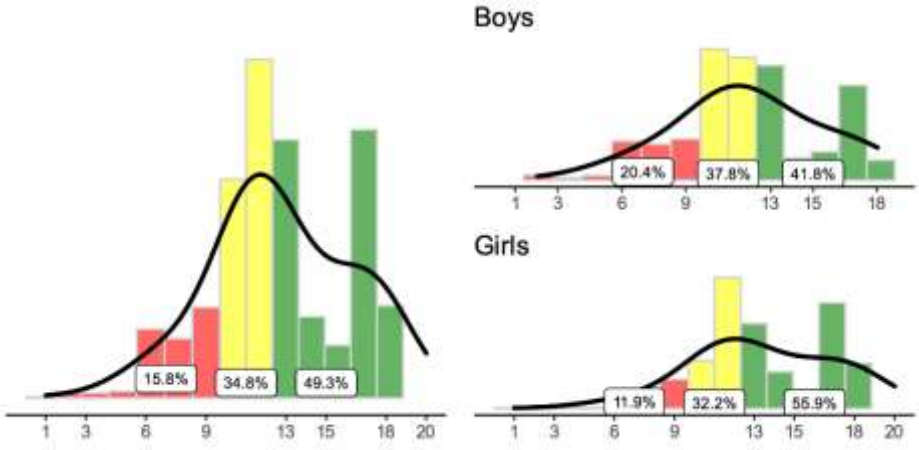


Figure 67: *Western Cape: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

The scores for this domain are unevenly distributed, with large clusters of scores in the *Falling Behind* category and the *On Track* category.

- The average score for this domain is 12.76, with a small SD of 3.46.
- Overall, almost half of Western Cape children are *On Track* for this domain, while 15.8% are *Falling Far Behind*.
- As with the other domains, girls perform significantly better than boys (55.9% are *On Track*, compared with 41.8% respectively).

7.7.3. Emergent Numeracy and Mathematics

Table 73: *Western Cape: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.75	3.84	0.47	7.93	4.03	14.70	559
Boys	8.31	3.75	0.45	7.92	3.80	14.81	268
Girls	9.14	3.88	0.56	9.08	4.03	14.70	291

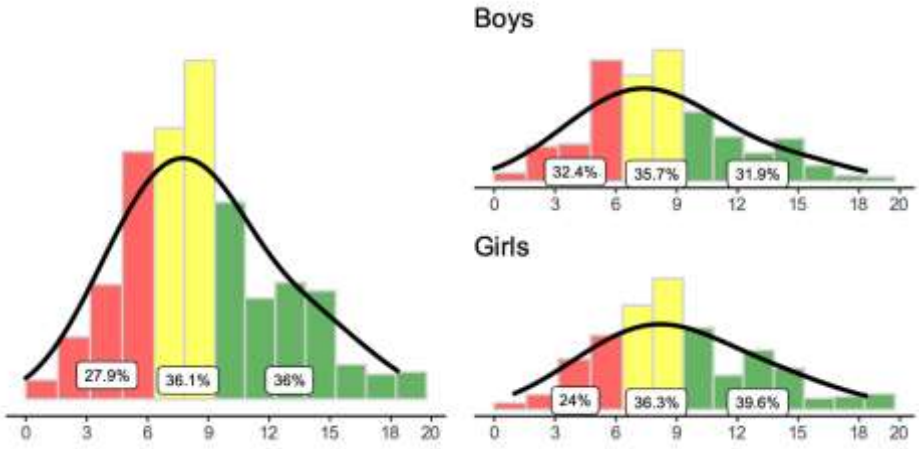


Figure 68: *Western Cape: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

These scores depicted in the figure show a normal, although slightly skewed, distribution, with more children achieving lower scores.

- On average, children scored 8.75 (SD = 3.84).
- There are roughly similar proportions of Western Cape children *Falling Far Behind* (27.9%), *Falling Behind* (36.1%) and *On Track* (36%) for this domain.
- However, girls performed better than boys, with fewer *Falling Far Behind* and more being *On Track* for this domain (39.6% of girls compared with 31.9% of boys).

7.7.4. Cognition and Executive Functioning

Table 74: *Western Cape: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	9.63	4.68	0.61	9.25	3.37	15.97	559
Boys	8.98	4.64	0.62	8.81	3.11	15.73	268
Girls	10.18	4.65	0.63	10.50	3.94	15.97	291

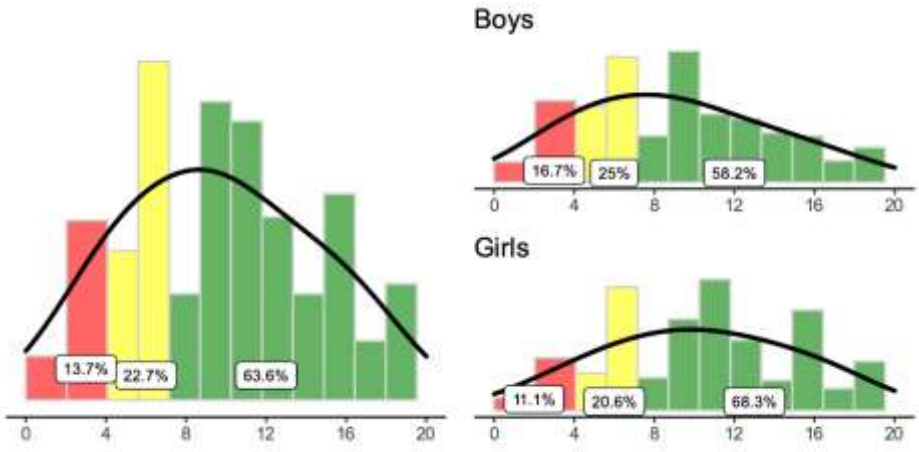


Figure 69: *Western Cape: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

Children in the Western Cape produced promising results in this domain:

- Children scored 9.63 on average (SD = 4.68).
- 63.6% of children are *On Track*, while 22.7% are *Falling Behind* and only 13.7% are *Falling Far Behind*.
- On average, there is no evident sex difference. However, the distributions of ELOM 4&5 bands vary: 68.3% of girls are *On Track*, with only 11.1% *Falling Far Behind*, while 58.2% of boys are *On Track* and 16.7% are *Falling Far Behind*.

7.7.5. Emergent Literacy and Language

Table 75: *Western Cape: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	12.48	4.42	0.62	12.91	6.49	18.33	559
Boys	11.83	4.50	0.62	11.66	5.91	18.33	268
Girls	13.03	4.27	0.63	13.15	7.06	18.33	291

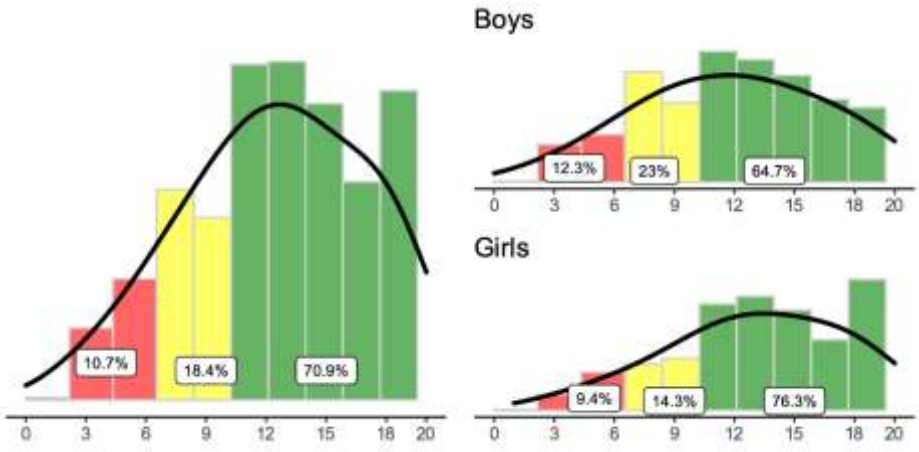


Figure 70: *Western Cape: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

Children in the Western Cape performed particularly well in this domain:

- Children achieved, on average, 12.48 (SD = 4.42).
- The distribution of ELL scores is skewed, with the majority (70.9%) of children achieving the expected standard.
- These positive results are even more prominent in girls, where 76.3% are *On Track* and only 9.4% are *Falling Far Behind* the standard.

7.8. KwaZulu-Natal

Table 76: Provincial summary

Sample	575 children
	278 (48%) boys and 297 (52%) girls
	Children were drawn from 138 ELPs across 48 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 242 (42.1%) Quintile 2 n = 126 (21.9%) Quintile 3 n = 128 (22.3%) Quintile 4 n = 43 (7.5%) Quintile 5 n = 36 (6.3%)
Social-Emotional Functioning	13.9% of children don't achieve the expected score for Social Relations with Peers and Adults 22% of children don't achieve the expected score for Emotional Readiness for School
Stunting	1.95% of children have stunted growth, (1.9% moderately stunted and 0.05% severely stunted
ELOM Total Score (details below)	Overall, 29.5% of children are *On Track*, 33.6% are *Falling Behind* and 36.9% are *Falling Far Behind* the expected standard for Early Learning
Summary	Overall, the development of most children in KwaZulu-Natal is not *On Track*. Children perform particularly poorly in ENM, CEF and FMC-VMI domains. Girls tend to perform better than boys.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 77: *KwaZulu-Natal: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	N
Total	39.67	11.63	0.87	39.10	23.81	53.97	575
Boys	38.16	11.50	1.23	37.68	22.78	52.43	278
Girls	41.10	11.59	0.80	40.43	25.11	57.36	297

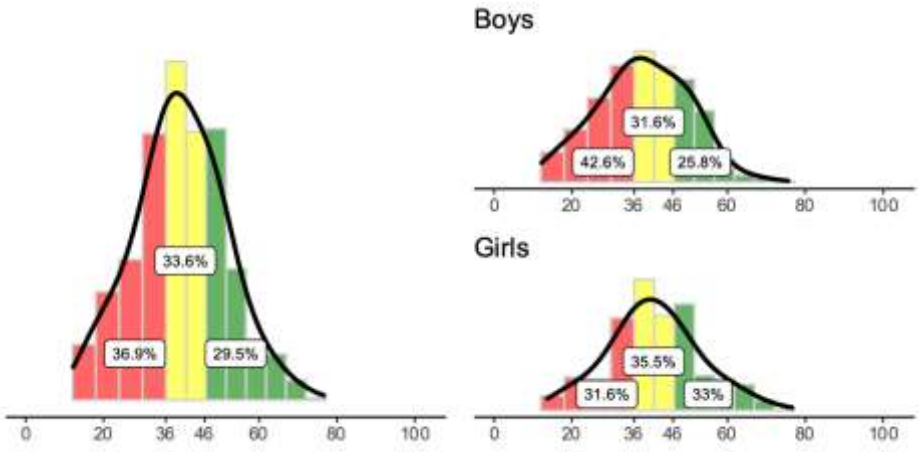


Figure 71: *KwaZulu-Natal: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 77 shows that in KwaZulu-Natal:

- The mean Total ELOM 4&5 Score is low at 39.67 (SD =11.63).
- Girls perform better than boys with mean scores of 41.10 (SD = 11.59) and 38.16 (SD = 11.50) respectively. This 3-point difference is small but meaningful (Cohen's *d* = 0.38).

ELOM 4&5 Total Scores are approximately normally distributed. However, differences exist between the proportions of children who are *On Track* (for achieving the ELOM 4&5 standard), *Falling Behind* and *Falling Far Behind* the expected standard.

- Only 29.5% of children in KwaZulu-Natal are *On Track*, while 33.6% are *Falling Behind* and a further 36.9% are *Falling Far Behind* the standard.
- More girls are *On Track* (33%), with 31.6% *Falling Far Behind*, while only 25.8% of boys are *On Track* and a large 42.6% are *Falling Far Behind*.

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.8.1. Gross Motor Development

Table 78: *KwaZulu-Natal: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.20	3.89	0.21	7.75	2.91	12.97	575
Boys	8.17	3.74	0.35	8.27	3.43	12.92	278
Girls	8.24	4.03	0.21	7.60	2.91	14.37	297

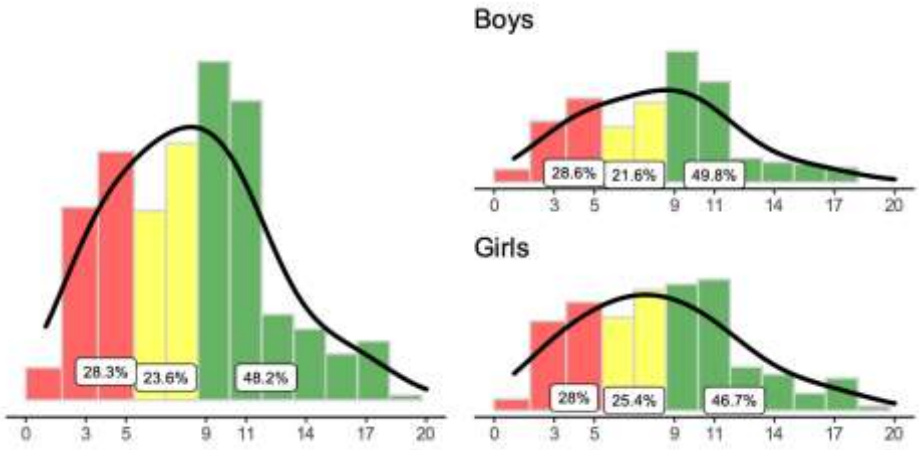


Figure 72: *KwaZulu-Natal: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

The distribution of scores is asymmetrical, with a slight skew.

- The average score for GMD is 8.20 (SD = 3.89).
- Overall, 48.2% of children are *On Track*, 23.6% are *Falling Behind* and 28.3% are *Falling Far Behind*.
- Sex differences are negligible, although slightly more boys (49.8%) are *On Track* than girls (46.7%).

7.8.2. Fine Motor Coordination and Visual Motor Integration

Table 79: *KwaZulu-Natal: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	9.84	3.38	0.20	10.07	5.86	14.87	575
Boys	9.24	3.35	0.26	9.64	5.14	13.56	278
Girls	10.41	3.32	0.24	10.29	6.52	15.30	297

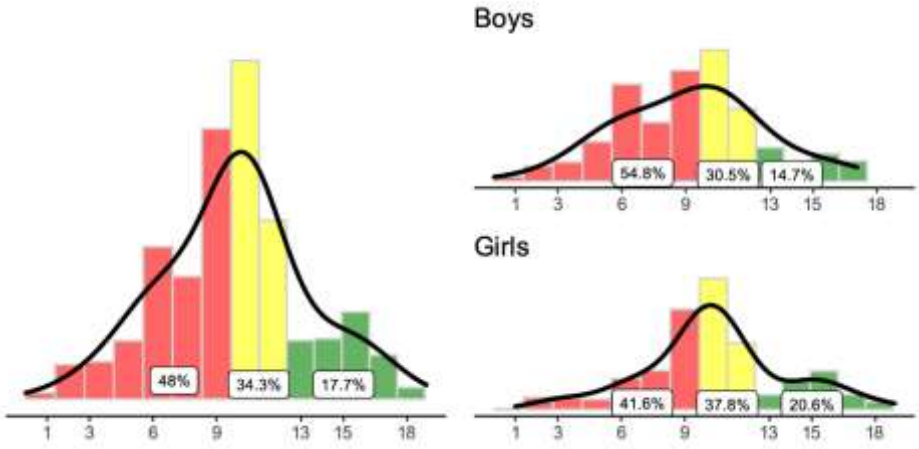


Figure 73: *KwaZulu-Natal: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

FMC-VMI scores are of particular concern:

- Children from KwaZulu-Natal score 9.84 (SD = 3.38) on average in this domain.
- In this domain, nearly half the children (48%) are *Falling Far Behind* the standard, followed by children who are *Falling Behind* (34.3%), with only 17.7% *On Track.*
- These worrying results are even more pronounced for boys, where 54.8% are *Falling Far Behind* and only 14.7% are *On Track*.

7.8.3. Emergent Numeracy and Mathematics

Table 80: *KwaZulu-Natal: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	6.49	3.50	0.28	6.27	2.38	11.10	575
Boys	6.41	3.51	0.38	5.45	2.38	11.10	278
Girls	6.57	3.50	0.37	6.27	2.38	11.74	297

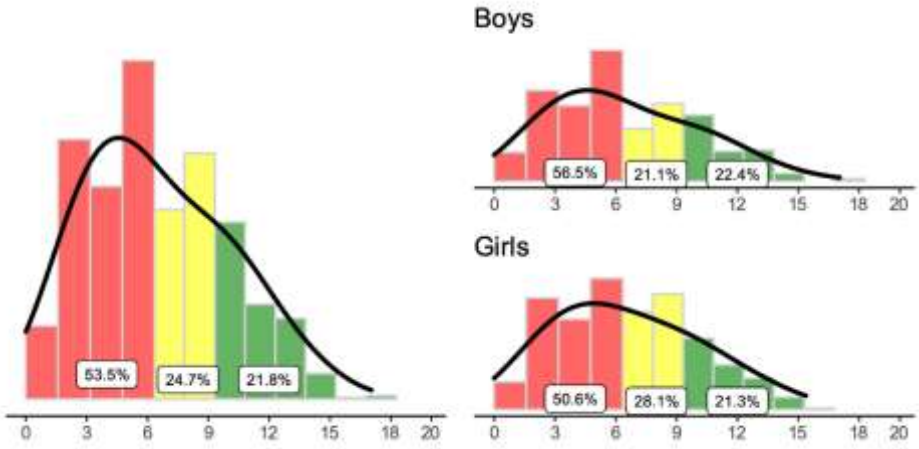


Figure 74: *KwaZulu-Natal: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

ENM scores are also concerning:

- The mean score for the whole sample is only 6.49 (SD = 3.50). This large standard deviation in relation to the mean is indicative of a large amount of variation within the individual scores for this domain.
- Overall, 53.5% of children are *Falling Far Behind* the ENM standard in KwaZulu-Natal.
- Once again, this is worse in the case of boys, where 56.5% are *Falling Far Behind*, and 50.6% of girls are *Falling Far Behind*.

7.8.4. Cognition and Executive Functioning

Table 81: *KwaZulu-Natal: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	5.45	3.40	0.19	5.22	1	10.16	575
Boys	5.35	3.39	0.27	5.22	1	9.83	278
Girls	5.55	3.42	0.23	5.03	1	10.73	297

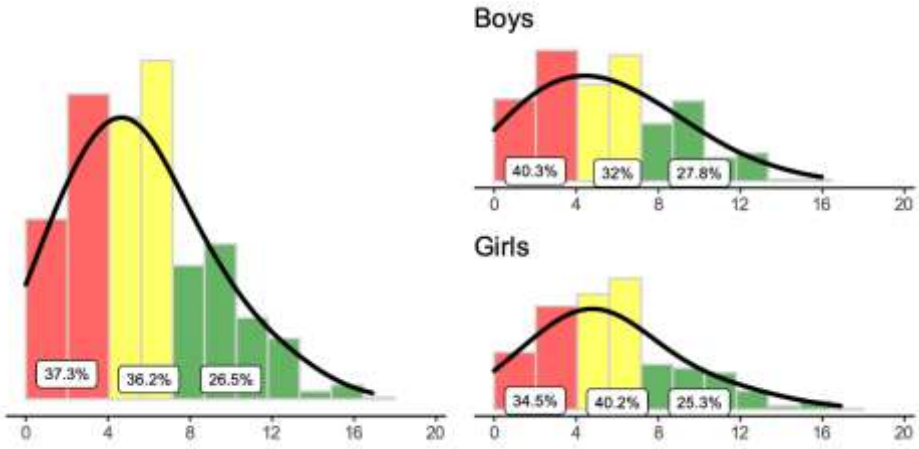


Figure 75: *KwaZulu-Natal: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

- On average, KwaZulu-Natal children scored poorly on CEF, with a mean of 5.45 (SD = 3.40).
- Most children (73.5%) are not *On Track* for this domain, and only 26.5% of children are.
- On average, there is no difference between boys and girls. However, as in the previous domains, the majority of boys (40.3%) are *Falling Far Behind* the standard, while only 27.8% are *On Track*. The case is not much better for girls.

7.8.5. Emergent Literacy and Language

Table 82: *KwaZulu-Natal: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	9.68	4.04	0.25	9.70	4.87	15.12	575
Boys	8.99	3.90	0.31	9.13	3.72	14.22	278
Girls	10.33	4.07	0.30	10.47	5.91	15.52	297

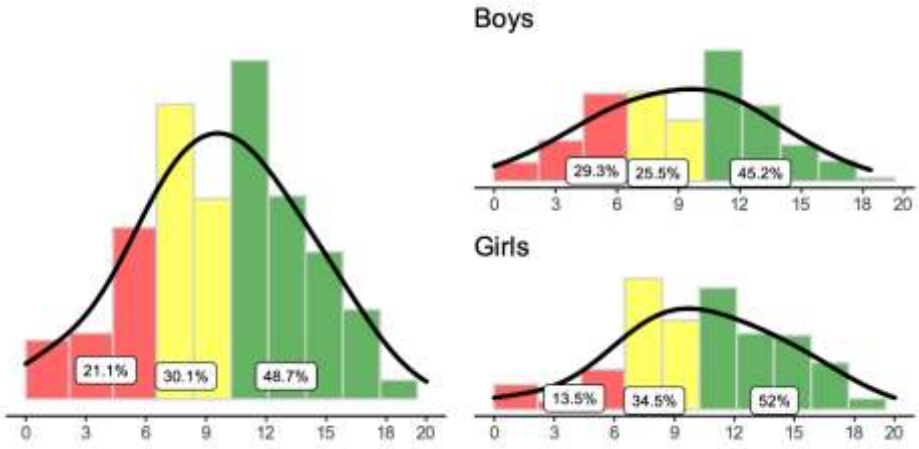


Figure 76: *KwaZulu-Natal: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

Children in KwaZulu-Natal showed more promising results in the ELL domain:

- Children achieved a mean score of 9.68 (SD = 4.04).
- 48.7% are *On Track*, and only 21.1% are *Falling Far Behind*.
- The distribution of ELOM 4&5 bands for this domain for the province is promising, especially for girls. A total of 52% of girls and 45.2% of boys are *On Track*.

7.9. Limpopo

Table 83: Provincial summary

Sample	578 children.
	295 (51%) boys and 283 (49%) girls
	Children were drawn from 145 ELPs across 47 sampling clusters
The quintile breakdown of this sample, computed with unweighted data	Quintile 1 n = 225 (38.9%) Quintile 2 n = 247 (42.7%) Quintile 3 n = 94 (16.3%) Quintile 4 n = 0 (0%) Quintile 5 n = 12 (2.1%)
Social-Emotional Functioning	17.1% of children don't achieve the expected score for Social Relations with Peers and Adults 31.1% of children don't achieve the expected score for Emotional Readiness for School
Stunting	7.5% of children have stunted growth, (6.49% moderately stunted and 1% severely stunted
ELOM Total Score (details below)	Overall, 44.7% of children are *On Track*, 28.5% are *Falling Behind* and 26.8% are *Falling Far Behind* the expected standard for Early Learning
Summary	Limpopo shows some promising results for the ELL domain. However, FMC-VMI and CEF are weak, especially for boys.

Question 1: For learning outcomes overall (the ELOM 4&5 Total Score), what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* (red)?

Table 84: *Limpopo: Descriptive statistics for Total ELOM 4&5 Score*

	Mean	SD	SE	Median	p_10	p_90	n
Total	44.69	12.67	0.65	44.33	29.17	61.15	578
Boys	43.20	12.40	0.72	42.52	28.48	59.25	295
Girls	46.21	12.78	1.05	46.91	30.47	62.42	283

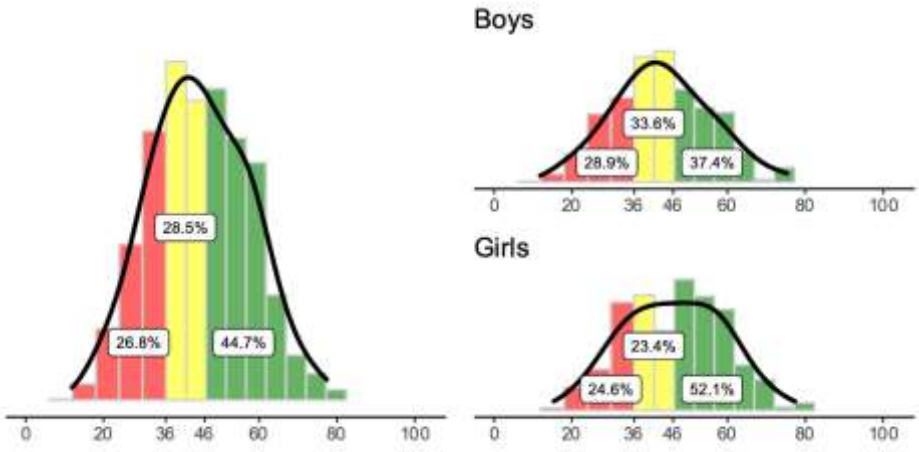


Figure 77: *Limpopo: Frequency distributions, with density curves overlaid, for Total ELOM 4&5 Score, separated by sex*

Table 84 shows that:

- Children in Limpopo achieved a mean ELOM 4&5 Total Score of 44.69 (SD = 12.67).
- Girls scored 3 points higher, on average, than boys, with a mean score of 46.21 (SD = 12.78) compared with 43.20 (SD = 12.40) respectively (Cohen's $d = 0.24$, indicating a small effect).

ELOM 4&5 Total Scores show a reasonable approximation towards a normal distribution. **Figure 77** shows that:

- 44.7% of Limpopo children achieve the standard, while 26.8% are *Falling Far Behind*.
- On average, more girls are *On Track* than boys (52.1% versus 37.4%); 28.9% of boys are *Falling Far Behind* the standard, compared with 24.6% of girls.

Question 2: For each of the five ELOM 4&5 learning domains, what proportion of children are *On Track* (green), *Falling Behind* (yellow) and *Falling Far Behind* the standard (red)?

7.9.1. Gross Motor Development

Table 85: *Limpopo: Descriptive statistics for Gross Motor Development*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.39	3.41	0.22	8.16	3.91	12.92	578
Boys	8.14	3.32	0.23	7.60	3.91	12.81	295
Girls	8.64	3.50	0.28	8.67	3.91	12.97	283

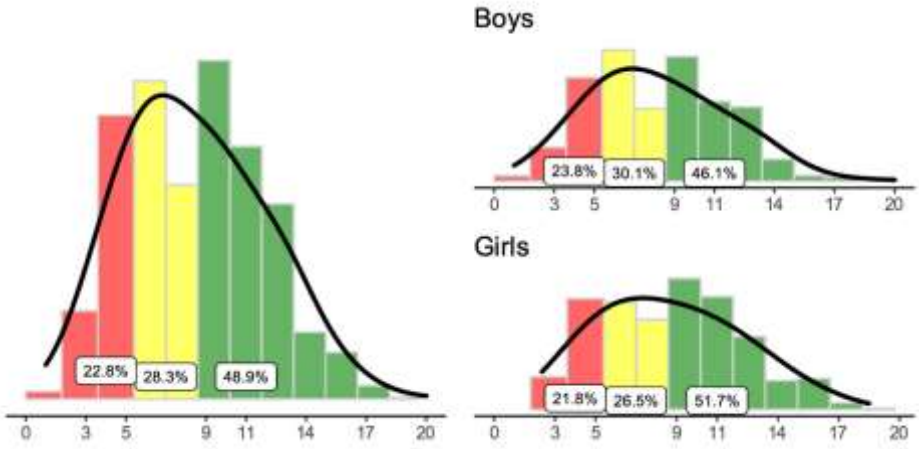


Figure 78: *Limpopo: Frequency distributions, with density curves overlaid, for Gross Motor Development, separated by sex*

Scores for this domain show little variation across the sample.

- On average, children in Limpopo achieved a mean GMD score of 8.39 (SD = 3.41).
- Nearly half of children are *On Track*, while 22.8% are *Falling Far Behind*.
- Girls perform slightly better than boys in this domain, with 51.7% of girls *On Track*, compared with 46.1% of boys.

7.9.2. Fine Motor Coordination and Visual Motor Integration

Table 86: *Limpopo: Descriptive statistics for Fine Motor Coordination and Visual Motor Integration*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.80	3.44	0.19	10.73	6.52	15.96	578
Boys	10.37	3.44	0.21	10.29	6.23	15.96	295
Girls	11.24	3.40	0.26	11.27	6.88	15.96	283

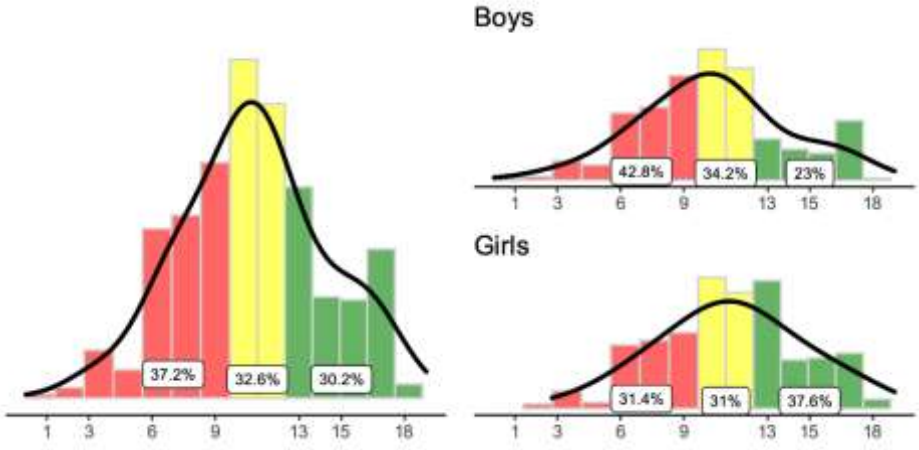


Figure 79: *Limpopo: Frequency distributions, with density curves overlaid, for Fine Motor Coordination and Visual Motor Integration, separated by sex*

These scores are unevenly distributed, with large clusters of scores comprising those in the *Falling Far Behind* category, those *Falling Behind* and those *On Track* for meeting the expected standard.

- The average score for this domain is 10.80 (SD = 3.44).
- Overall, a concerning 69.8% of Limpopo children are not *On Track* to meet the expected standard for FMC-VMI.
- As with the other domains, girls perform significantly better than boys (37.6% of girls are *On Track*, compared with only 23% of boys) and 31.4% of girls are *Falling Far Behind* compared with 42.8% of boys.

7.9.3. Emergent Numeracy and Mathematics

Table 87: *Limpopo: Descriptive statistics for Emergent Numeracy and Mathematics*

	Mean	SD	SE	Median	p_10	p_90	n
Total	8.80	3.70	0.15	8.90	3.85	13.57	578
Boys	8.43	3.64	0.21	7.96	3.80	13.57	295
Girls	9.19	3.73	0.19	9.34	4.03	13.69	283

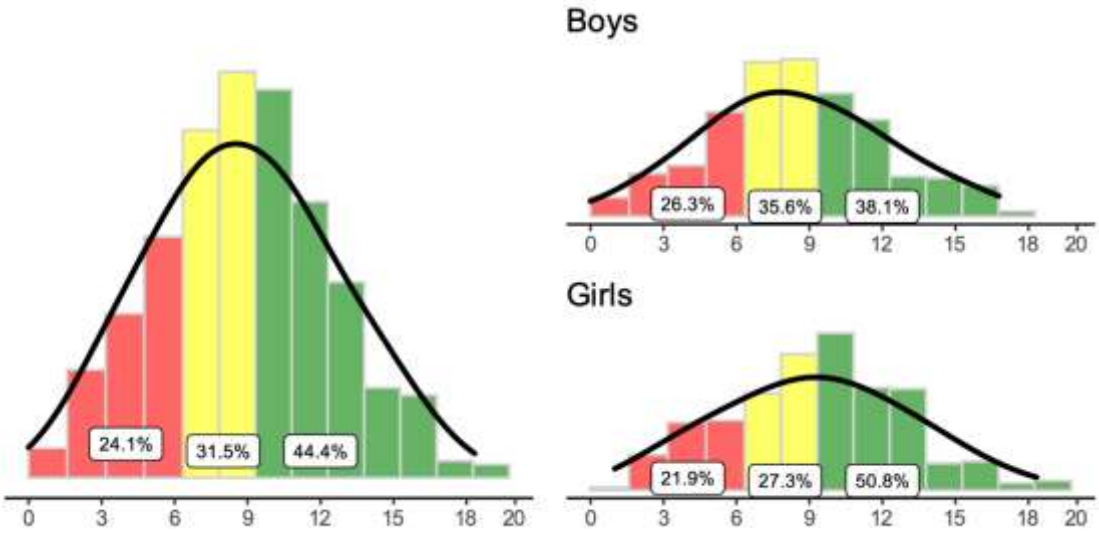


Figure 80: *Limpopo: Frequency distributions, with density curves overlaid, for Emergent Numeracy and Mathematics, separated by sex*

These scores approximate a normal distribution.

- On average, children scored 8.80 (SD = 3.70).
- 44.4% of children in Limpopo are *On Track* and 24.1% of children are *Falling Far Behind* in ENM.
- More than half (50.8%) of girls are *On Track*, compared with only 38.1% of boys.

7.9.4. Cognition and Executive Functioning

Table 88: *Limpopo: Descriptive statistics for Cognition and Executive Functioning*

	Mean	SD	SE	Median	p_10	p_90	n
Total	6.31	3.67	0.18	6.05	2.26	10.92	578
Boys	6.01	3.51	0.20	5.37	2.11	10.92	295
Girls	6.62	3.82	0.30	6.29	2.26	11.50	283

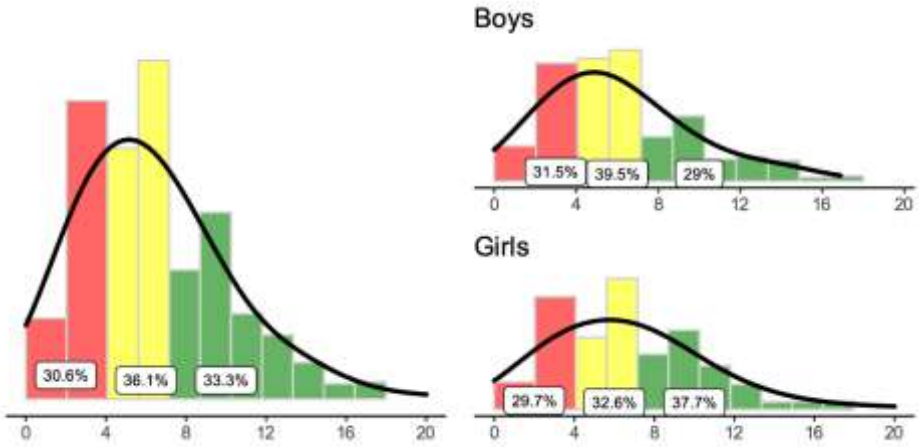


Figure 81: *Limpopo: Frequency distributions, with density curves overlaid, for Cognition and Executive Functioning, separated by sex*

These scores show a normal, although slightly skewed, distribution, as a greater proportion of children achieved lower scores. Children in Limpopo produced poor results in this domain:

- Children scored 6.31 on average (SD = 3.67).
- Only 33.3% of Limpopo children are *On Track*, while 36.1% are *Falling Behind* and 30.6% are *Falling Far Behind*.
- On average, there is no evident sex difference. However, the ELOM 4&5 band distributions vary: 37.7% of girls are *On Track*, with 29.7% *Falling Far Behind*, while only 29% of boys are *On Track* and 31.5% are *Falling Far Behind*.

7.9.5. Emergent Literacy and Language

Table 89: *Limpopo: Descriptive statistics for Emergent Literacy and Language*

	Mean	SD	SE	Median	p_10	p_90	n
Total	10.38	4.74	0.33	10.48	4.44	16.78	578
Boys	10.25	4.70	0.34	10.27	4.17	16.66	295
Girls	10.52	4.78	0.40	10.60	4.44	17.56	283

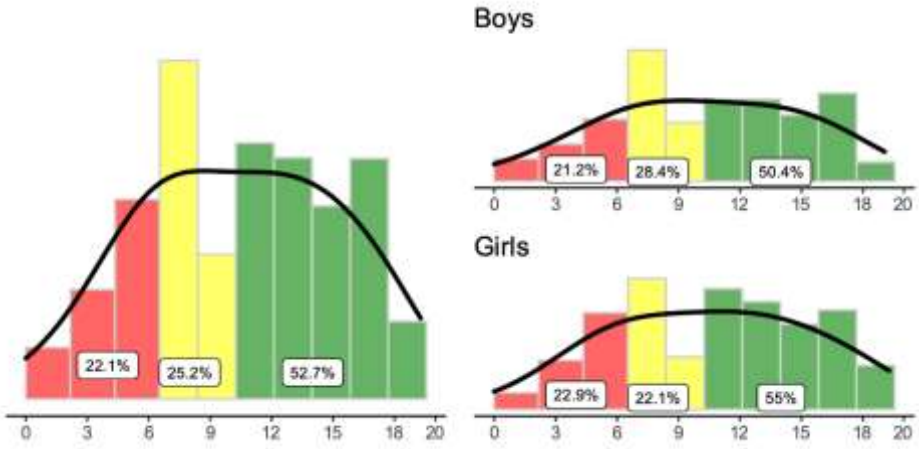


Figure 82: *Limpopo: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex*

The scores are more uniformly distributed than in the other domains, with similar proportions of scores achieved across the range of possible scores. Of the five domains, this is the most promising:

- Children in Limpopo achieved a mean score of 10.38 (SD = 4.74) for this domain.
- More than half of Limpopo children (52.7%) are *On Track* for achieving the expected standard in ELL.
- This is even more prominent among girls, where 55% are *On Track*, compared with 50.4% of boys.

8. Appendices

8.1. Appendix: Methods, weighting

Document received from Stephen Taylor, reporting the work on constructing sample weights, with Grace Bridgman, Servaas van der Berg and Janeli Kotzé.

Sampling weights for ECD index

A first step is to calculate the weight associated with every school, which is the inverse of the probability of that school's selection. The stratification in terms of province and quintile means that this weight is given by the total number of schools in a Province-Quintile cell ($\square\square_{\square}$) divided by the number of schools selected in that Province-Quintile cell ($\square\square_{\square}$):

(1) $\square\square_{\square} = \frac{\square\square_{\square}}{\square\square_{\square}}$

For example, according to Equation 1, if 10 schools were selected out of a possible 100 schools in a particular Province-Quintile cell, then $\square\square_{\square} = 10$.

Then, a few steps are needed to calculate the appropriate weights to give to each centre sampled in an ECD programme cluster. The first step is to calculate the relative weight given to ECD Centre i relative to other sampled centres within a cluster. This is given by 1 divided by the number of ECD centres within each cluster (where the cluster is given by the school identified).

(2) $\square_{\square\square} = \frac{1}{\square\square\square\ \square\square\ \square\square\square\square\square\square\square}$

The next step is to make the weights given to the cluster commensurate to the estimated population size of that cluster, which is proxied for by Grade 3 enrolments (Grade 2 can also work). Grade 1 is not optimal since the rate of grade repetition is often especially high in Grade 1, thus creating inflated enrolment numbers. Grade R or pre-Grade R enrolments at schools would also not be ideal since in many schools the numbers enrolled in these grades are significantly lower than the numbers enrolled in Grade 1 or above. Since nearly 100% of primary school-aged children are indeed enrolled in primary school, the number of Grade 3 enrolments therefore represents a good estimate of the population of young children in the area around the school. An important caveat to acknowledge is that if the ECD participation rate in an area is different from the school participation rate, this will lead to a degree of bias in the representivity. But this potential bias is likely to be far less than that which would occur if no weights were included to proxy for the child population in the area, and at this stage the school enrolment numbers are the best available proxy. The centre weight is then adjusted as follows:

(3) $\square_{\square} = \square_{\square\square} * \square\square 3\square\square\square$

The next issue is to assign each sampled child (learner) a weight, which is simply the weight assigned to a centre (which already takes into consideration the size of the centre and the size of the linked school) divided by the number of children who were sampled:

(4) $$\square_{\square} = \frac{\square_{\square}}{\square_{\square}}$$

For example, if Centre *i* had sampled 5 children, then the learner weight should be 20/5 = 4.

Finally, we combine the stratification weight with this learner weight to create a total weight to be associated with each learner in the dataset as follows:

(5) $$\square\square\square\square\square\square_{\square} = \square\square_{\square} * \square_{\square}$$

For example, each learner in Centre *i* should be given a weight of 10*4 = 40.

Applying these weights to the sample allows us to interpret results as roughly representative of children attending ELPs near to primary/combined schools.

8.2. Appendix: Methods, sample breakdown by province and quintile

Table 90: *Breakdown of sample by province, quintile and sex (unweighted data)*

Quintile	Sex	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape
1	Male	111	118	31	117	110	86	114	100	60
1	Female	108	126	31	125	115	94	126	106	61
2	Male	85	53	31	60	132	76	51	70	52
2	Female	99	60	41	66	115	78	56	82	54
3	Male	80	66	86	63	48	54	103	41	41
3	Female	80	66	78	65	46	62	108	51	36
4	Male	4	15	60	25	NA	40	17	26	51
4	Female	7	22	62	18	NA	40	13	42	53
5	Male	4	26	70	13	5	28	NA	38	64
5	Female	9	24	81	23	7	30	NA	44	87

NA = no data

8.3 Appendix: Survey glm approach

An alternative approach to running the linear models we report in the main report is to use methods that take the survey design and sampling weights into account. We have conducted such an analysis using the R package "survey", and in particular the function svyglm. We find that coefficient and standard error estimates are slightly different (and more conservative in the case of svyglm), but none of our substantive conclusions would be changed. The table of model coefficients is reported immediately below.

In the descriptive statistics reported earlier, we used a sampling weight correction, as explained in the Method section. However, we did not use a weight correction in the regression modelling. There are several reasons for not doing so, and many authors point to disadvantages in including sampling weights for regression models. Lumley (2010) concludes "… it often makes little practical difference whether sampling weights are used in fitting regression models… when there is a substantive difference [between weighted and unweighted analyses] it may indicate that a few influential observations happen to have large sampling weights, so that neither the weighted nor the unweighted analysis is entirely reliable".

Nevertheless, we decided to run an alternate analysis on the data, using the svyglm() function from the R "survey" package (Lumley, 2020). The results reported below are for the same model specification as discussed earlier, but run with sampling weights in svyglm. Note the coefficients in the table are unstandardised.

Table 91: *Appendix: Modelling with survey weights included*

term	estimate	std.error	statistic	p <
(Intercept)	-32.23	6.77	-4.76	0.001
Age_months	1.07	0.12	8.92	0.001
Stunted mild stunt vs none	-2.01	0.66	-3.05	0.001
Stunted mod stunt vs none	-4.46	1.25	-3.57	0.001
Stunted severe stunt vs none	-3.29	2.98	-1.10	0.27
Quintile_natemls 2 vs 1	1.02	0.87	1.18	0.24
Quintile_natemis 3 vs 1	3.08	1.03	2.99	0.001
Quintilenatemis 4 vs 1	8.05	1.22	6.58	0.001
Quintile_natemis 5 vs 1	6.51	3.16	2.06	0.04
Sex	1.79	0.52	3.46	0.001

The coefficients and statistical tests based on this model largely correspond to those in the mixed linear model run earlier. We find that socio-economic status (measured in our sample by quintile (natemis) score) has a large effect on Total ELOM 4&5 Scores, particularly in the case of quintiles 4 and 5. For example, a change from quintile 1 to quintile 4 will result in an increase of 8.05 ELOM 4&5 points. Note, the standard errors here are relatively large in relation to the coefficients, which again points to a large amount of variance in the data, but are also a consequence (often thought desirable, and more accurate) of using sampling weights. Also note that there is no significant difference between children's performance in quintile 1 and 2. Moderate growth stunting has a strong impact on the Total ELOM 4&5 Score. Moderately stunted children will score 4.46 points lower on the ELOM 4&5 Total than children who have no stunting, with all other variables held constant. In turn, mildly stunted children will score 2.01 points lower on the ELOM 4&5 Total than children who are not stunted, with all other variables in the model held constant. Sex, age and socio-emotional development also have significant effects on Total ELOM

4&5 Scores. We conclude that there is no substantive difference between the linear modelling using unweighted data and that using weighted data, at least for our purposes.

8.4. Appendix: Predictors omitted from regression model

We considered several additional predictors for our regression modelling, but which we did not end up including. We report some reasons and analyses here to clarify these decisions.

An interesting potential predictor was the "dosage", i.e., cumulative amount of time spent by children in the Early Learning Programmes that were the location for data collection in the ELOM 4&5 survey. We created a variable that reflected this, by multiplying the teacher-reported average attendance in the last term (variable "attendance") with the total truncated (as discussed earlier) number of months the child was enrolled (variable "months_enrolment_trunc").

Unfortunately, data pertaining to years of enrolment and average attendance at the ELP was seriously incomplete in the sample, and we did not feel it could be entered in the final model.

Table 92: *Missing data table for dosage variables*

skim_variable	n_missing	complete_rate
total_elom	0	1.00
attendance	1,402	0.73
months_enrolment	1,486	0.72
dosage	1,486	0.72

When we enter dosage into the mixed linear model described earlier, it has a negligible, if statistically significant relationship to the Total ELOM 4&5 Score, once adjusted for other variables in the model, as shown in the table below.

Table 93: *ANOVA summary table for mixed linear modelling of ELOM 4&5 Total*

Variable	Chisq	df	p <
Age	182.06	1	.001
Growth (stunting)	55.29	3	.001
Quintile_natemis	44.58	4	.001
Sex	34.42	1	.001
Socio-emotional combined	408.64	1	.001
Dosage	3.68	1	.001

As can be seen from the detailed table of contrasts, the effect for dosage, both when unstandardised and standardised, is negligible. What can also be seen, though, is that some of the other coefficients in the model have been substantively affected, suggesting patterns of intercorrelation that we do not fully understand.

Table 94: *Coefficient summary table for mixed linear modelling of ELOM 4&5 Total including dosage*

Predictors	Estimates	std. Error	std. Beta	standardised std. Error	CI	standardised CI	p
(Intercept)	-29.64	3.91	-0.13	0.05	-37.31 – -21.96	-0.23 – -0.04	**<0.001**
age months	0.94	0.07	0.19	0.01	0.80 – 1.08	0.16 – 0.22	**<0.001**
stunted [Mild stunt]	-2.19	0.45	-0.16	0.03	-3.07 – -1.32	-0.23 – -0.10	**<0.001**
stunted [Mod stunt]	-4.88	0.79	-0.36	0.06	-6.43 – -3.33	-0.48 – -0.25	**<0.001**
stunted [Severe stunt]	-3.19	2.20	-0.24	0.16	-7.51 – 1.12	-0.56 – 0.08	0.147
quintile natemis [2]	0.09	0.85	0.01	0.06	-1.58 – 1.76	-0.12 – 0.13	0.915
quintile natemis [3]	1.26	0.89	0.09	0.07	-0.48 – 3.00	-0.04 – 0.22	0.157
quintile natemis [4]	5.48	1.25	0.41	0.09	3.02 – 7.94	0.22 – 0.59	**<0.001**
quintile natemis [5]	6.89	1.31	0.51	0.10	4.33 – 9.45	0.32 – 0.70	**<0.001**
gender [Female]	2.06	0.35	0.15	0.03	1.37 – 2.75	0.10 – 0.20	**<0.001**
socioemotional combined	1.10	0.05	0.32	0.02	0.99 – 1.21	0.29 – 0.35	**<0.001**
dosage	0.01	0.00	0.03	0.02	-0.00 – 0.01	-0.00 – 0.06	0.055
Random Effects							
σ^2	94.04						
$\tau_{00\ id\_ecd}$	39.51						
$\tau_{00\ id\_cluster\_sample}$	18.70						
ICC	0.38						
$N_{\ id\_cluster\_sample}$	342						

8.5. Average fees paid for children aged 4-6 years as a predictor

We mentioned that a potentially interesting predictor, given some earlier research, is the average fee charged in ELPs for children in the age range 4 to 6 years. However, this variable had a great many missing observations, and was strongly correlated with some other predictors (in particular with quintile, treated as a numeric variable). We preferred to keep quintile as a proxy for socio-economic advantage, especially since data was nearly complete for that variable.

Table 95: *Missing data table for dosage variables*

skim_variable	n_missing	complete_rate
quintile	212	0.96
fees_amount_4_6	3,134	0.4

8.6. Appendix: Age distribution across other variables

A point of some interest is whether the distribution of child's age is even across some important variables in the dataset. It might, for instance, be that apparent differences across quintiles or provinces or sex might be explicable in terms of age differences.

We considered this briefly and report a breakdown below. We do not think that it is an important source of difference, and it should also be noted that the ELOM 4&5 does NOT take age into account or suggest any corrections for age in the technical manual, thus essentially treating age in the 50 to 59 months range as an uninvestigated source of variation. It is, however, possible that some of the differences we reported in various places in the report would change if adjusted for age differences.

Table 96: *Age (in months) distribution data across several variables (weighted sample)*

	Mean	SD	Lower 95% CI	Upper 95% CI	Median	md_se
Eastern Cape	54.67	2.69	54.35	54.98	55	0.25
Free State	54.58	2.63	54.22	54.94	55	0.25
Gauteng	54.55	2.66	54.26	54.84	55	0.25
KwaZulu-Natal	54.67	2.79	54.26	55.07	55	0.25
Limpopo	55.13	2.48	54.81	55.45	55	0.25
Mpumalanga	55.13	2.73	54.76	55.50	55	0.25
North West	54.75	2.55	54.46	55.05	55	0.25
Northern Cape	55.12	2.94	54.69	55.54	55	0.25
Western Cape	54.73	2.82	54.32	55.13	55	0.25
Male	54.82	2.70	54.67	54.98	55	0.25
Female	54.71	2.68	54.53	54.90	55	0.25
Quintile 1	54.75	2.64	54.56	54.94	55	0.25
Quintile 2	54.89	2.66	54.67	55.11	55	0.25
Quintile 3	54.86	2.69	54.56	55.16	55	0.25
Quintile 4	54.61	2.72	54.26	54.96	55	0.25
Quintile 5	54.51	2.82	54.17	54.85	54	0.25

The following tables shows a) the mean and SD for performance of children for each month in the age range 50 to 59 months in the national sample, and b) the percentage of children in each month who fall into the ELOM 4&5 bands.

Table 97: *Total ELOM 4&5 Scores by age in months*

Age (in months)	n (unweighted)	Mean ELOM total	SD ELOM total	Falling Far Behind	Falling Behind	On Track
50	342	39.03	13.87	43.2%	24.6%	32.1%
51	456	39.28	12.69	40.8%	31.7%	27.5%
52	507	41.78	13.54	39.6%	26.3%	34.1%
53	532	42.95	14.14	33%	25.2%	41.8%
54	538	43.35	13.04	31.8%	29.3%	38.9%
55	657	44.46	12.66	27.6%	28.3%	44.2%
56	577	45.76	12.60	21.7%	29.8%	48.6%
57	552	45.74	13.38	23.6%	29.3%	47.1%
58	638	49.70	13.68	17.7%	22.8%	59.4%
59	423	51.32	13.37	12.4%	21.7%	65.9%

This table suggests that it might be prudent for the ELOM 4&5 developers to consider creating criterion scores for the ELOM bands that are adjusted for child's age in months.

8.7. Appendix: Checking effect of questionable scores in Mpumalanga

We mentioned in the Method section that we were concerned about the data collection in Mpumalanga, regarding Item 23 on the ELOM. This item may have inflated the domain scores for ELL, and also the ELOM Total Score (since it sums over the domains). We therefore report computations in this section for the Mpumalanga sample for the domain in question, and the Total ELOM Score, with the cases in question removed.

Table 98: *Mpumalanga: Descriptive statistics for Total ELOM 4&5 Score, Item 23 bad cases removed*

_	Mean	SD	SE	Median	p_10	p_90	n
Total	50.87	11.98	1.31	51.34	35.10	66.89	474
Boys	49.28	12.12	1.52	47.47	34.59	67.13	229
Girls	52.38	11.67	1.27	54.05	35.96	66.11	245

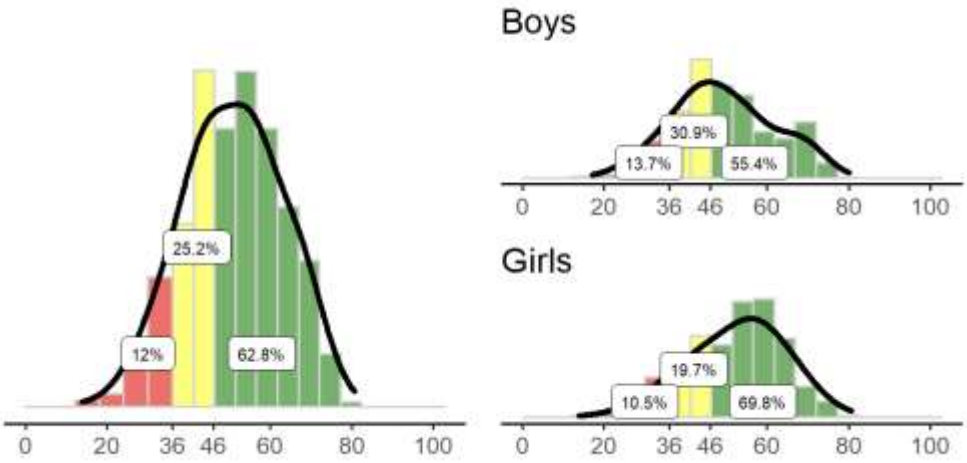


Figure 83: *Mpumalanga: Frequency distributions, for Total ELOM 4&5 Score, separated by sex, Item 23 bad cases removed*

Emergent Literacy and Language

Table 99: *Mpumalanga: Emergent Literacy and Language, Item 23 bad cases removed*

_	Mean	SD	SE	Median	p_10	p_90	n
Total	11.69	4.34	0.52	11.76	5.91	17.56	474
Boys	11.26	4.33	0.60	11.38	5.59	17.56	229
Girls	12.09	4.31	0.51	12.67	6.16	17.56	245

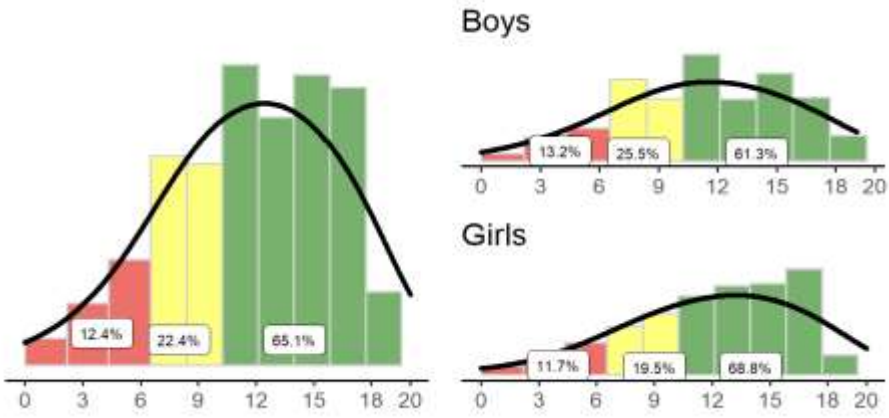
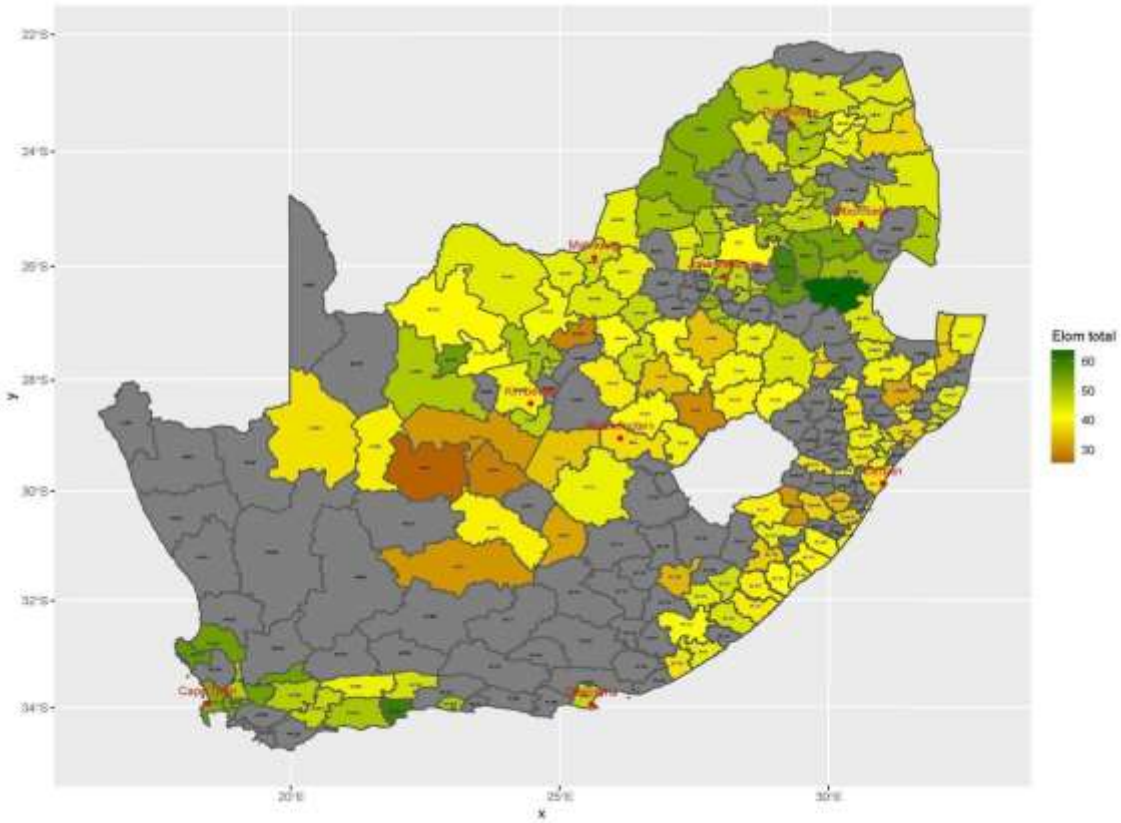


Figure 84: *Mpumalanga: Frequency distributions, with density curves overlaid, for Emergent Literacy and Language, separated by sex, Item 23 bad cases removed*

The reader should refer back to the main report. The differences are very small, and we do not think that the results are substantially affected by keeping or removing the bad Item 23 cases.

8.8. Appendix: Total ELOM 4&5 Scores per ward (unweighted data)



The Index was made possible with the support of the American people through a contract with the United States Agency for International Development (USAID).

This Thrive by Five Technical Report was also produced under a subcontract with the ECD Measure Group, hosted at the University of Nebraska Medical Center under the Research Technical Assistance Center (RTAC) contract. The RTAC is made possible by the generous support of the American people through USAID under the terms of contract no. 7200AA18C00057.

The contents do not necessarily represent the views of USAID or the United States Government.