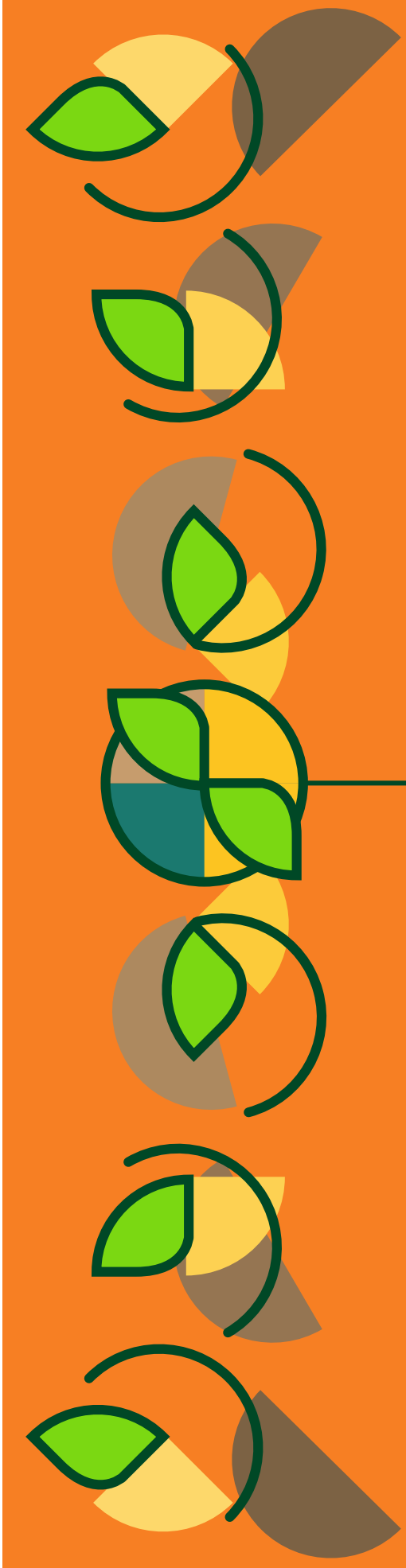

Roots and Shoots

WAVE 2 REPORT

October 2023

Research from early learning to school outcomes

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mr price foundation

Executive Summary

This report presents the results of the second wave of the Roots and Shoots study. The study, a first of its kind in South Africa, aims to track learners from when they start school through the Foundation Phase in an attempt to investigate how inequalities in learning outcomes in the early grades can be traced back to inequalities that were already present at the start of formal schooling. Learners were assessed at the start of Grade R in 2022 and the start of Grade 1 in 2023. The same learners will be assessed again in Grade 2 and Grade 3. Given the severe inequality that characterizes the South African schooling system, one of the key questions investigated in this report is how learning outcomes changed for learners in schools with different levels of resources.

We present new evidence on learning gains that are achieved during Grade R. The evidence presented in this report is unique in that it is the first direct evidence from South Africa on what happens during the Grade R year. Since the same learners were assessed at the start of Grade R and the start of Grade 1, it is possible to investigate how learning outcomes changed during the course of a year.

Gaps between learners at different levels of development decreased during Grade R. An encouraging finding presented in this report is that learners who were the most developmentally behind at the beginning of Grade R experienced the largest learning gains during Grade R. The gap in ELOM scores between learners who were falling far behind developmentally and those who were on-track developmentally halved between the two waves of assessment. This points to the importance of Grade R in preparing learners who are lagging behind developmentally for formal schooling.

Socio-economic disparities in school readiness remain. The results in this report show that the socio-economic inequalities in developmental outcomes observed in Wave 1 of the Roots and Shoots study were maintained in Wave 2.

Gaps between learners from different socio-economic backgrounds widened between Wave 1 and Wave 2. Results from the multivariate analysis show that learners in better resourced schools learned more during Grade R than their counterparts in more disadvantaged schools. This points to a widening of the gap between learners from different socio-economic backgrounds over the course of just one year.

These results have important implications for education policy and practice, and can be summarized as follows:

Efforts at expanding access to Grade R should be maintained. The evidence that learners who were lagging furthest behind at the start of Grade R achieved the largest gains points to the importance of attending Grade R for addressing developmental gaps and preparing learners for Grade 1.

The quality of Grade R instruction in no-fee schools must be improved. While government's efforts at improving the quality of instruction in Grades 1-3 are undoubtably important, it is crucial that these efforts are extended to Grade R. For Grade R to achieve its potential to reduce socio-economic disparities in school readiness, it is essential that learners in no-fee schools enjoy the same quality of instruction as those in fee-charging schools. This will require increasing opportunities for in-service training focused on providing teachers with practical strategies for supporting early learning and opportunities to observe and practice best teaching.

Acknowledgements

This project is funded by the Mr Price Foundation. Many thanks to ikapadata for expertly managing the fieldwork for the first two rounds of data collection, and the dedicated ELOM assessors who assessed the learners in Grade R and Grade 1. Thank you to the caregivers of the participants who provided their support for this study by consenting to their children being assessed. Thank you to Funda Wande for providing administrative support.

1. Introduction

1.1. About the Roots and Shoots study

1.1.1. Background to the study

It is now widely acknowledged that most South African learners do not acquire foundational literacy and mathematics by the end of Grade 3 (Spaull & Pretorius, 2022) and that this is one of the binding constraints to progress in South Africa. While we know that poor-quality schooling certainly contributes to these poor schooling outcomes, evidence from a wide range of disciplines including biology, human development, educational psychology, cognitive science and economics has shown that there is a strong link between the skills that children enter school with and their later outcomes. Recognising this evidence, there has been a global effort toward investing in early childhood as a strategy for improving children's later life outcomes.

Despite this evidence, we still know very little about the skill formation of learners growing up in the global South, where low quality schooling often dominates explanations for learners' poor educational outcomes, and crowds out other potential explanations such as low levels of school readiness among children when they enter school. The Roots & Shoots study aims to fill this gap by measuring a sample of South African children's early skills as they enter school, and following them across time to understand the link between these early skills and later schooling outcomes. By collecting data on children as they first enter school and then following these same children over time, we can determine to what extent the patterns of performance seen in Grade 3 can be traced back to trends already there on the first day of school.

The Roots & Shoots study aims to answer the following questions:

- What are the foundational skills levels of learners when they first enter school?
- To what extent can the patterns of performance seen in Grade 3 be traced back to trends already there on the first day of school?

1.1.2. The importance of Grade R

Grade R is the first year of formal schooling in South Africa, and attendance is compulsory for all children. Recognising the international evidence on the importance of early childhood development programmes for improving later learning outcomes, the DBE embarked on a massive expansion of the Grade R programme in primary schools in 2001, with the number of learners enrolled in Grade R at a primary school increasing threefold between 2001 and 2012 (from 242,000 to 768,000) (Taylor, 2014). It was hoped that expanding Grade R would become an equaliser to reduce social disadvantages (Taylor, 2014). The DBE commissioned an evaluation of the impact of this expansion of Grade R on later learning outcomes and found that, sadly, Grade R did not universally contribute towards better learning. A main finding of the report was that the quality of Grade R instruction is critical in determining the impact on later learning outcomes. Crucially, the results showed that attending Grade R was positively associated with learning outcomes in the later grades in more advantaged (Quintile 4 & 5) schools, but that there was no association between attending Grade R and later learning outcomes in disadvantaged (Quintile 1-3) schools. This result suggested that instead of acting as an equaliser, Grade R in fact worsened inequalities between learners from different socio-economic backgrounds.

1.1.3. The importance of tracking learners through Grade R

To date, there is no direct local evidence on what children learn during Grade R. The previously mentioned report on the impact of Grade R by the DBE (DBE, 2014) did not use data from the same learners to estimate the impact of Grade R. Instead, the impact of Grade R was estimated retrospectively by linking a cohort of Grade 6 learners' home language and mathematics results to the proportion of that cohort who had attended Grade R. The "treatment" evaluated in the report was the proportion of learners in a cohort who had attended Grade R, and meant that the impact of Grade R could only be estimated for the overall cohort, not individual learners.

The evidence from the second wave of the Roots and Shoots study is therefore unique in that the same learners were followed from the beginning of Grade R through to the beginning of Grade 1. Assessing learners at the beginning of Grade R and again at the beginning of Grade 1 allows us to introduce new evidence on how much children learn in Grade R, as well as how socio-economic status impacts on these results. This allows us to bring important evidence to bear on whether Grade R works as an equaliser, or whether Grade R exacerbates inequalities between learners from different socio-economic backgrounds.

1.2. Summary of Wave 1 results

The first wave of data collection was conducted in Term 1, 2022. 587 Grade R learners distributed across 75 schools in the Western Cape were assessed using the Early Learning Outcomes Measure (ELOM) 4&5 assessment tool. The results showed that 38% of the sampled learners were not meeting the standard for being developmentally on-track, and that there were clear socio-economic differences in earl learning outcomes. Learners in schools charging higher fees far outperformed learners in no-fee and low-fee schools in the ELOM 4&5 assessment, and were much more likely to be developmentally on-track. At the same time, there was much variability across socio-economic status in ELOM 4&5 scores. Specifically, there were many learners in no-fee schools who were developmentally on-track, a phenomenon which has been noted in other samples of children assessed with the ELOM tool. A recent report by Henry & Giese (2023) explores the factors that predict this "positive deviance". A key question arising from this finding was what happens to these learners as they progress through school – do they maintain their advantage, or do their learning outcomes converge to the low average of their classmates? We present some preliminary evidence towards answering this question in this report.

2. Study design and methods

2.1. Sampling

2.1.1. The Afrikaans sample

The Roots and Shoots study takes advantage of an existing research study that aims to evaluate the impact of an intervention jointly implemented by a Non-Governmental Organisation (Funda Wande) and the Western Cape Education Department (WCED) that targeted foundational literacy and mathematics in 50 treatment schools, whose outcomes were compared with 50 control schools. Within each educational district, statistical techniques were used to select the comparison schools such that they matched the treatment schools as closely as possible on performance on the Grade 3 systemic assessments from 2017 to 2019. Roots & Shoots assessed the early learning skills of Grade R children as they entered formal schooling (i.e. in Term 1) in 50 schools that were part of the evaluation study (i.e. half of the schools in the Funda Wande evaluation study). These schools are all located in the four Metro and Cape Winelands education districts (i.e. give of the eight districts in the province). 366 Afrikaans learners were assessed in the first wave of data collection. Of these, 279 were assessed again in the first term of 2023 – that is, 76% of the original Afrikaans sample were retained in the second wave of data collection.

2.1.2. The isiXhosa sample

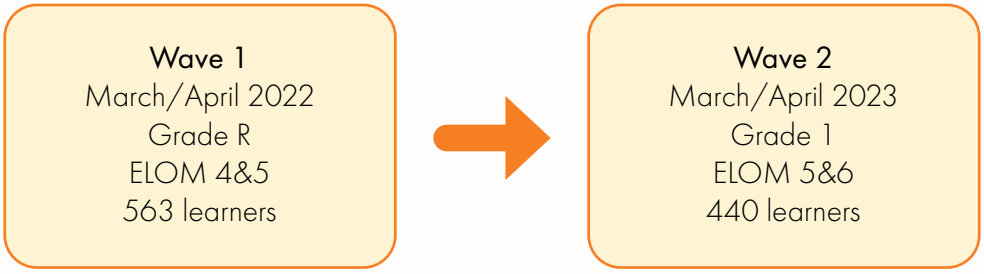
In addition to the 50 Afrikaans schools, Roots & Shoots assessed Grade R children in 25 schools with isiXhosa as the language of learning and teaching (LOLT) in the Western Cape. All 25 schools are located in Cape Town since this is where isiXhosa LOLT schools are concentrated in the province. The sample frame was further restricted to schools with at least 30 Grade R and 30 Grade 1 learners and excluded schools that had participated in the Funda Wande pilot study in 2021. Schools were stratified in quintiles of their average Grade 3 Systemic Evaluation performance between 2017 to 2019 and then within each stratum, five schools were randomly selected. The final isiXhosa sample consisted of 197 Grade R learners. Of these, 161 learners could be tracked into the second wave of data collection, implying a retention rate of 82% for the isiXhosa sample.

2.1.3. Sample retention

In total, 440 of the original 563 learners in the Roots and Shoots sample were assessed in Wave 2. Table 1 presents differences in the characteristics of tracked versus untracked learners. Untracked learners were more likely to be younger and slightly more likely to speak Afrikaans as their home language. Untracked learners were also more likely to attend low-fee schools. Importantly, the mean ELOM 4&5 scores of untracked learners was slightly lower than that of tracked learners, however this difference is not statistically significant. The sample of tracked learners is therefore not biased in terms of performance in the first wave of assessment.

Table 1: Differences between tracked and untracked learners

		Percentage	
		Tracked learners N=440	Untracked learners N=123
Age (months)	50-59 months	2.0	8.1
	60-69 months	98.0	91.9
Sex	Male	49.8	50.4
	Female	50.2	49.6
Home language	Afrikaans	63.3	69.9
	isiXhosa	36.7	30.0
School fee status	No-fee	74.3	66.7
	Low-fee	14.6	29.3
	Mid-fee	11.1	4.0
ELOM 4&5 score		58.7	56.3



Characteristics of the tracked sample are presented in Table 2. The table shows that the sample is equally split in terms of sex, and that 63.4% of learners speak Afrikaans as their home language. 30 of the learners (6.8%) had been in retained in Grade R in 2023. The table shows how learners are distributed across the school fee groups, with 74.3% of the sample attending no-fee schools, 14.6% attending low-fee schools, and 11.1% attending mid-fee schools.

Table 2: Characteristics of the Roots and Shoots sample

		N	Percentage
Age (months)	70-79 months	313	71.1
	80-89 months	127	28.9
Sex	Male	219	49.8
	Female	221	50.2
Home language	Afrikaans	279	63.4
	isiXhosa	161	36.6
Repeated Grade R	Yes	30	6.8
	No	410	93.2
School fee status	No-fee	327	74.3
	Low-fee	64	14.6
	Mid-fee	49	11.1

2.2. Measures

2.2.1.Learning outcomes

The ELOM tools

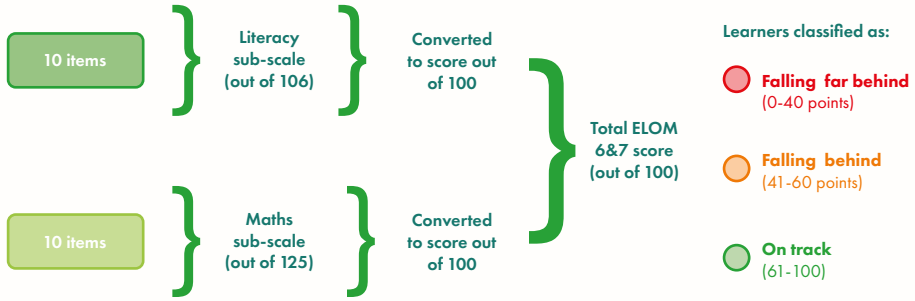
Both the first and the second wave of data collection made use of the ELOM tools to assess learners' early skills. In the first wave, ELOM 4&5 was used to assess Grade R learners (aged 50-69 months) in five developmental domains, including (i) gross motor development, (ii) fine motor coordination and visual motor integration, (iii) emergent numeracy and mathematics, (iv) cognition and executive functioning, and (v) emergent literacy and language. Items in each of these domains are scaled to produce a score out of 20 and scores on each domain are summed so that learners get an overall ELOM score out of 100. The ELOM 4&5 technical manual specifies cut-off points on each domain, as well as on the overall ELOM 4&5 assessment, that are associated with being developmentally "on track", "falling behind" and "falling far behind".

In the second wave, the same learners were assessed using the ELOM 6&7 tool in the first term of Grade 1. ELOM 6&7 was developed for measuring whether children are academically ready for Grade 1, and is appropriate for assessing children at the end of Grade R or the beginning of Grade 1 (aged between 70 and 89 months). The ELOM 6&7 tool measures two domains of school readiness, namely early literacy and early mathematics. The items that make up the instrumentwere developed using the Grade R Curriculum Assessment Policy Statements (CAPS), as well as research into the Grade 1 skills that predict children's future reading and mathematics abilities as they progress through the Foundation Phase.

Calculating overall scores

The ELOM 6&7 assessment tool consists of two sub-scales, namely literacy and mathematics. The literacy sub-scale consists of 10 items, while the mathematics sub-scale consists of 18 items. Scores on the literacy sub-scale were calculated as the total score across the items making up each sub-scale. The literacy items total to 106 points and the mathematics items total to 125 points. These raw scores were converted to percentages out of 100 to get the overall score on that sub-scale. These scores out of 100 were averaged to get the overall ELOM 6&7 score. Overall ELOM 6&7 scores were used to categorise learners into three bands: (i) Falling far behind (0-40 points), (ii) Falling behind (41-60 points), and (iii) On track (61-100 points). It is important to note that the ELOM 6&7 assessment tool has not been standardised and the psychometric properties of the tool have not yet been established, so the performance categories are not directly comparable with those in the ELOM 4&5 tool. The cut-off points used to classify learners into three bands are therefore somewhat arbitrary, and could be revised once the ELOM 6&7 tool has been standardised and its psychometric properties have been established. For this reason, we do not focus on the percentage of learners in different categories of school readiness in this report. Instead, the focus is on overall ELOM 6&7 scores. The categories of school readiness are only used to investigate relative movement of learners between categories across the two waves of assessment and to compare movement between different socio-economic groups.

Figure 1: Calculation of sub-scale and overall ELOM 6&7 scores



Calculating domain scores

The early literacy domain of ELOM 6&7 consists of five domains, namely (i) short-term and auditory memory, (ii) vocabulary and oral language, (iii) phonemic awareness and letter-sounds, (iv) shape recognition and writing, and (v) print skills. The early mathematics domain consists of four sub-domains, namely (i) number sense and operations, (ii) shape and space, (iii) data handling skills, and (v) patterns, functions and algebra.

Figure 2: Domains making up the literacy sub-scale of ELOM 6&7

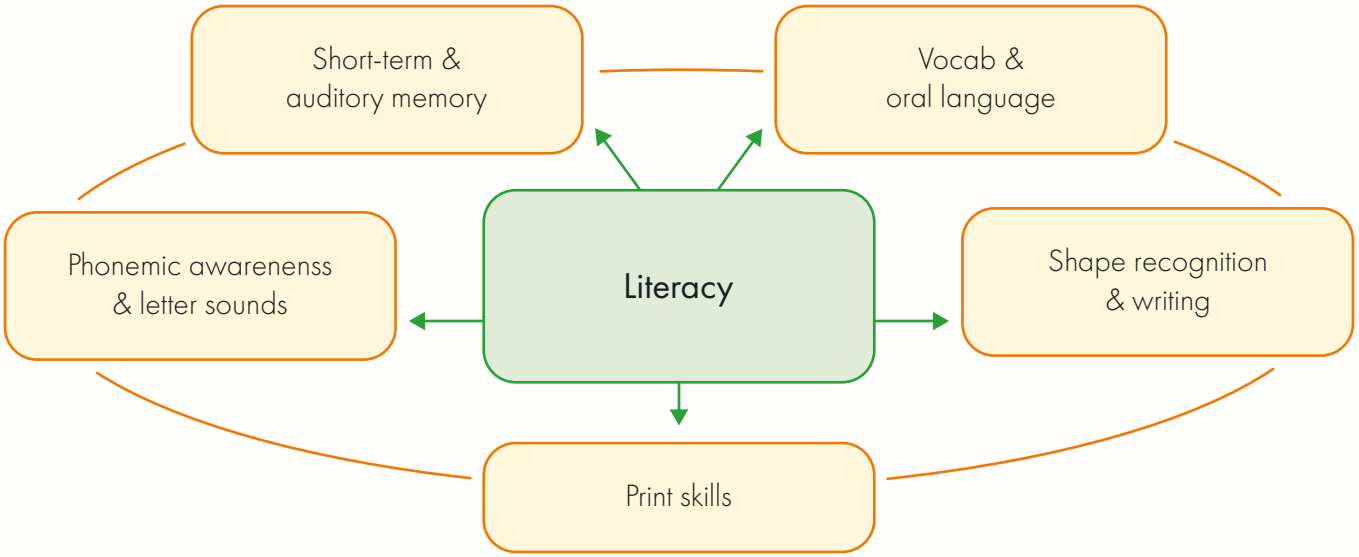
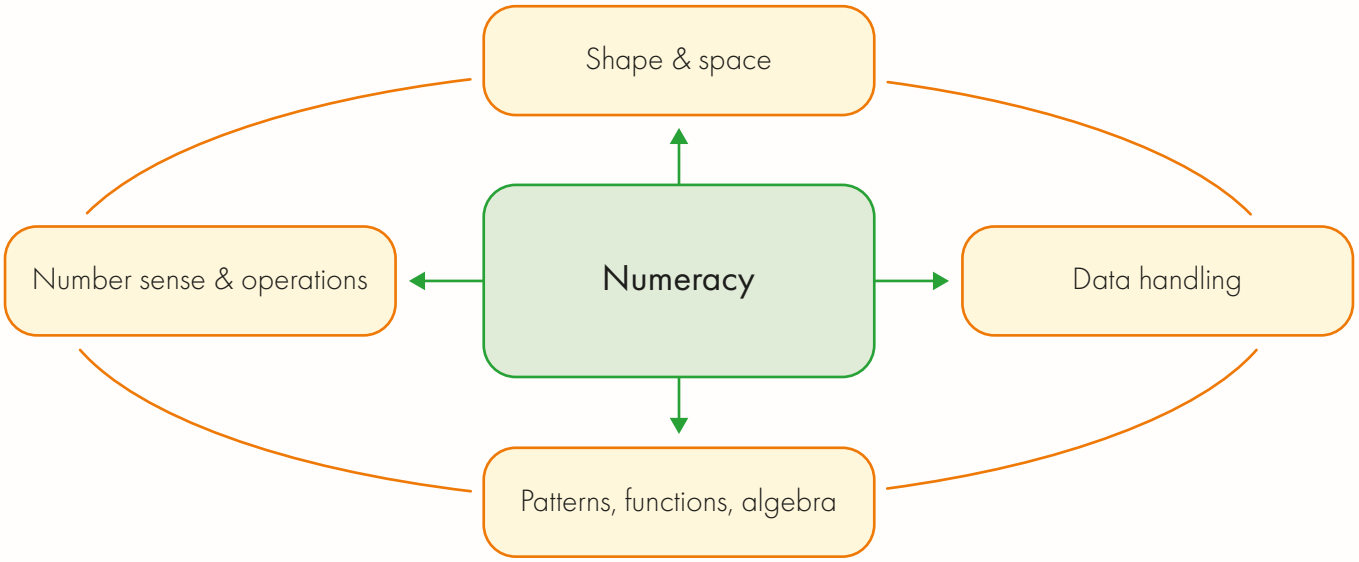


Figure 3: Domains making up the mathematics sub-scale of ELOM 6&7



Scores on each of the items making up these domains are expressed as percentage scores out of 100. Sub-scale scores are obtained by calculating the average score across the items making up that domain. Figure 4 presents an example of this by showing how the score on the short-term and auditory memory domain was calculated. The domain is assessed using two items, each of which is scored out of 100. The average score across the two items is calculated to obtain an overall score for the short-term and auditory memory domain.

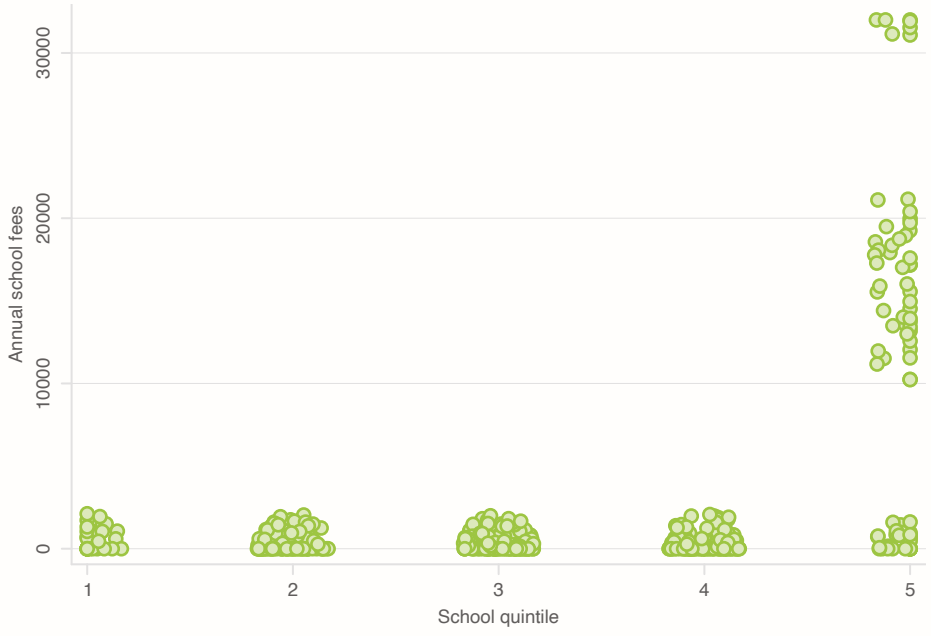
Figure 4: Example of calculation of domain scores

2.2.2. Socio-economic status

As is the case internationally, socio-economic status (SES) is a major determinant of learning outcomes in South Africa. Learners from wealthier backgrounds consistently achieve much better results than their disadvantaged peers. Since the main question that the Roots and Shoots study is whether patterns of performance between SES groups in the later grades can be traced back to differences between groups upon entering formal schooling, SES is a key variable of interest in the presentation of the Wave 2 results.

Unfortunately, we have limited information on the true SES of learners in the sample. This is because no home background information about learners was collected. As a result, we use the wealth of schools as a proxy for SES. School wealth is typically measured as the quintile classification of schools. Public schools in South Africa are split into quintiles of wealth such that Quintile 1-3 schools are typically no-fee schools and Quintile 4 and 5 schools typically charge fees. However, there are quite a number of Quintile 4 and 5 schools in the sample that do notcharge fees. This can be seen in Figure 5, which shows the annual fees charged by the Roots and Shoots schools across DBE quintiles. While all Quintile 1-3 schools were no-fee schools, there were also 92 out of 116 Quintile 4 schools that were in fact no-fee schools, and 11 out of 78 Quintile 5 schools that were no-fee schools. In this sense, the DBE quintiles are not a true reflection of the fee charging status of schools. We therefore present our analysis based on the fee-structure of schools, rather than school quintiles. We split schools into three groups, namely no-fee, low-fee (charging less than R3,000 per year) and mid-fee schools (charging more than R3,000 per year).

Figure 5: School fees by DBE quintile



Obsewrvation: 440

While school fees is not a perfect measure of SES, it is reasonable to assume that socio-economic disadvantage is highly correlated with school fees: more advantaged households are able to afford higher school fees, and are thus more likely to send their children to schools charging higher fees. Moreover, evidence shows that household SES and school fee status overlap to a great extent in South Africa (Spaull & Jansen, 2019).

2.3. Fieldwork

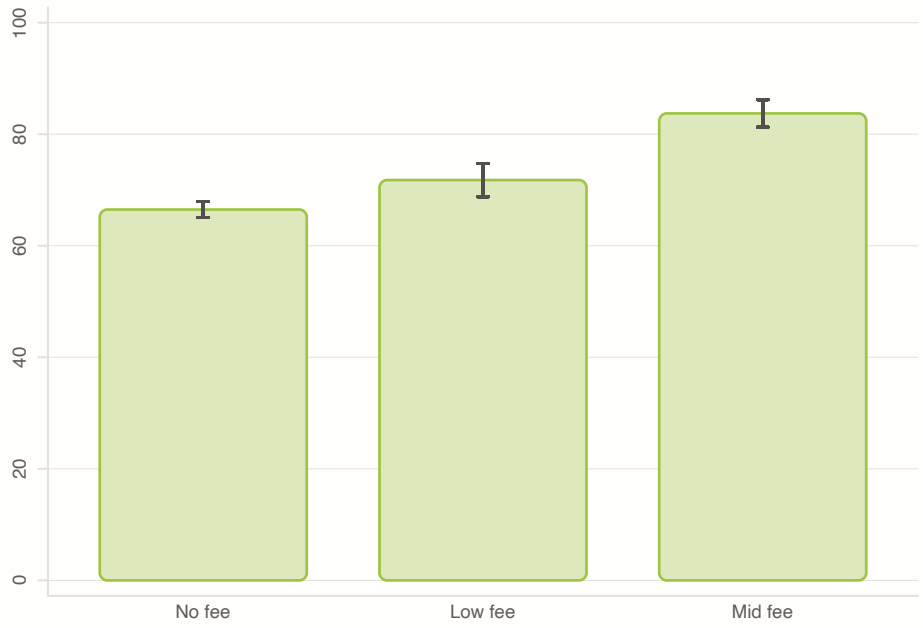
The first wave of data collection was conducted in March and April 2022 and the second wave was conducted in March and April of 2023. Assessors were all ELOM-accredited assessors. Assessments took place at the schools, in a quiet space away from other children. Each assessment took approximately 45 minutes, and each child was assessed in their home language. Ethical clearance for the study was obtained from the University of Cape Town's Commerce Faculty, and permission to conduct research in schools was granted by the WCED's Directorate of Research.

3. Results

3.1. Performance on ELOM 6&7

One of the main results from the first wave of assessment was that there were clear socio-economic differences in developmental outcomes, with learners in mid-fee schools outperforming learners in no-fee and low-fee schools in the ELOM 4&5 assessment. Figure 6 shows that this pattern was maintained in the second wave of assessment, with learners in mid-fee schools outperforming their peers in no-fee and low-fee schools by a statistically significant margin. Learners in mid-fee schools achieved an average ELOM 6&7 score of 83.7 points, while learners in low-fee schools achieved 71.8 points, and those in no-fee schools 66.5 points. It is noteworthy that the difference in scores between learners in no-fee and mid-fee schools was remarkably similar across the two waves of assessment – 16 points in Wave 1 and 17 points in Wave 2. As was the case in the first wave of assessment, the difference in scores between learners in no-fee and low-fee schools was not statistically significant.

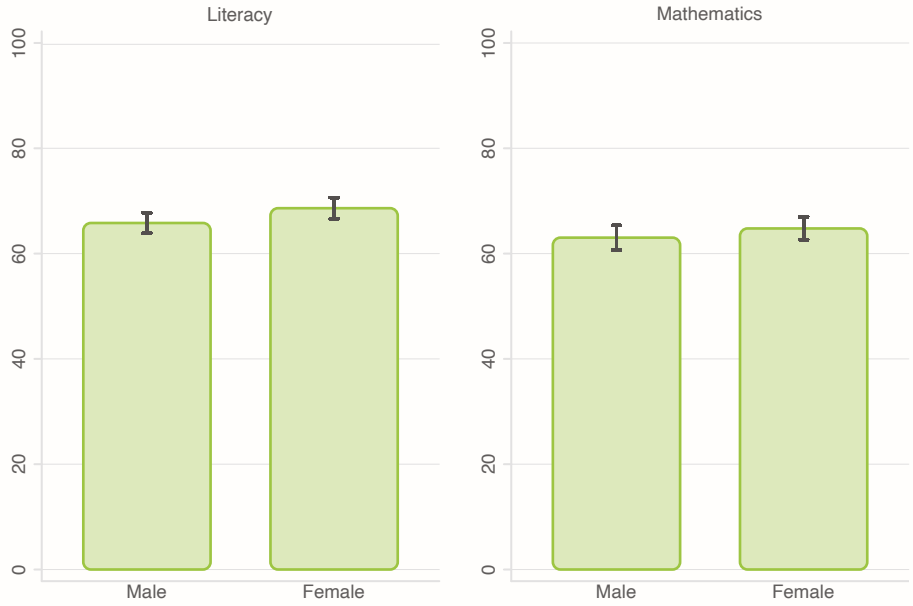
Figure 6: Mean ELOM 6&7 scores by school-fee group



Observation: 327 N0-fee, 64 Low-fee, 49 Mid-fee
Note: Error bars indicate 95% confidence intervals

The first wave of the study indicated no significant sex differences in ELOM 4&5 scores. This result, too, was maintained in the second wave of assessment. Figure 7 shows the performance of males and females in the literacy and mathematics sub-scales, and shows that while females slightly outperformed boys in both sub-scales, this difference was not statistically significant. The same is true for overall scores on the ELOM 6&7 assessment.

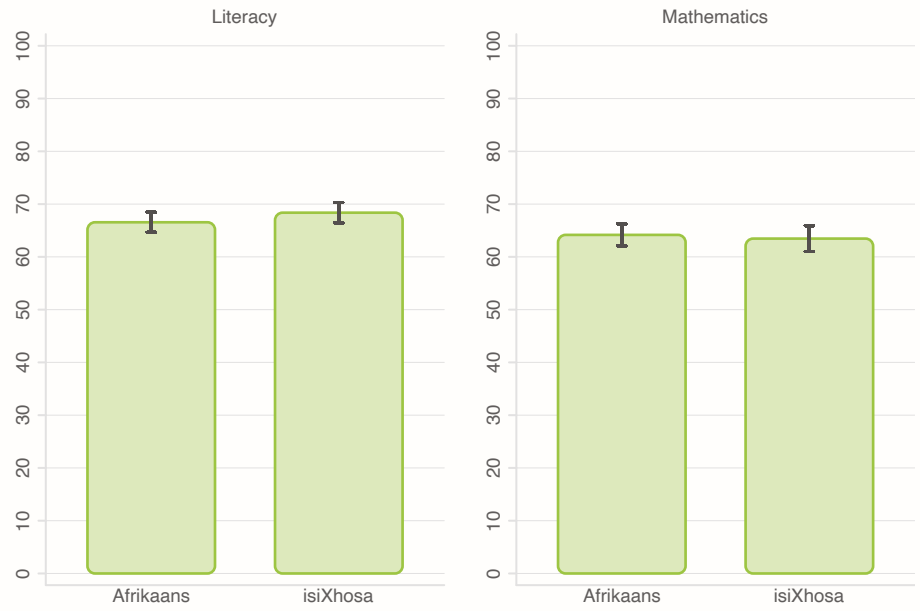
Figure 7: Performance in the literacy and mathematics sub-scales by sex



Observation: 219 Male, 221 Female
Note: Error bars indicate 95% confidence intervals

Language differences in the literacy and mathematics sub-scales are shown in Figure 8. While isiXhosa learners slightly outperformed Afrikaans learners in the literacy sub-scale, this difference was not statistically significant. Afrikaans learners slightly outperformed isiXhosa learners on the mathematics sub-scale, but this difference, too, was not statistically significant.

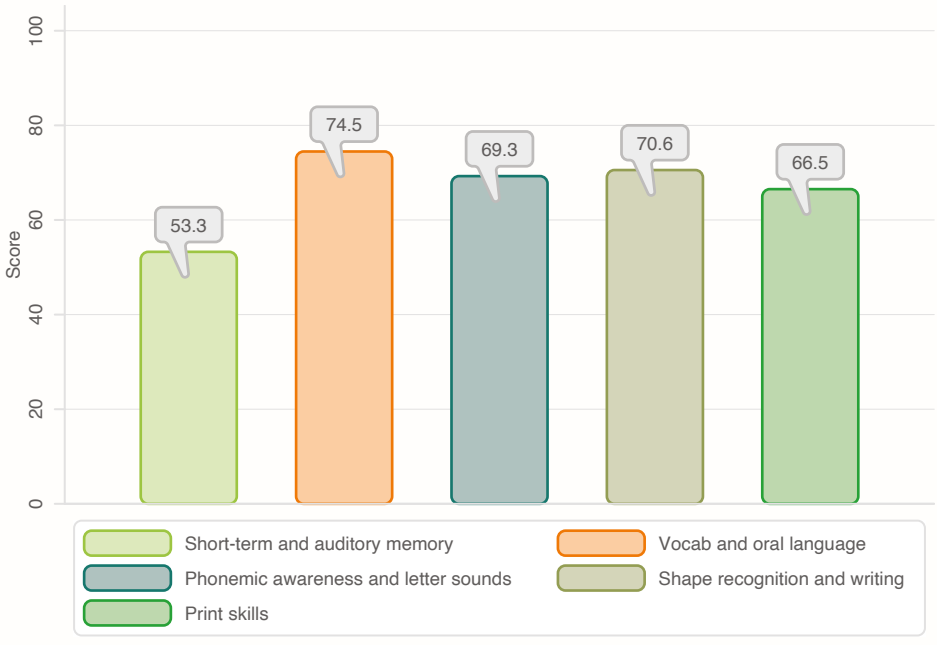
Figure 8: Performance in the literacy and mathematics sub-scales by language



Observations: 279 Afrikaans, 161 isiXhosa
Note: Error bars indicate 95% confidence intervals

Figure 9 shows how learners performed on the different domains of the literacy sub-scale of the assessment. Learners performed worst on the measure of short-term and auditory memory (scoring an average of 53.3 points out of 100) and best on vocabulary and oral language (74.5 points out of 100).

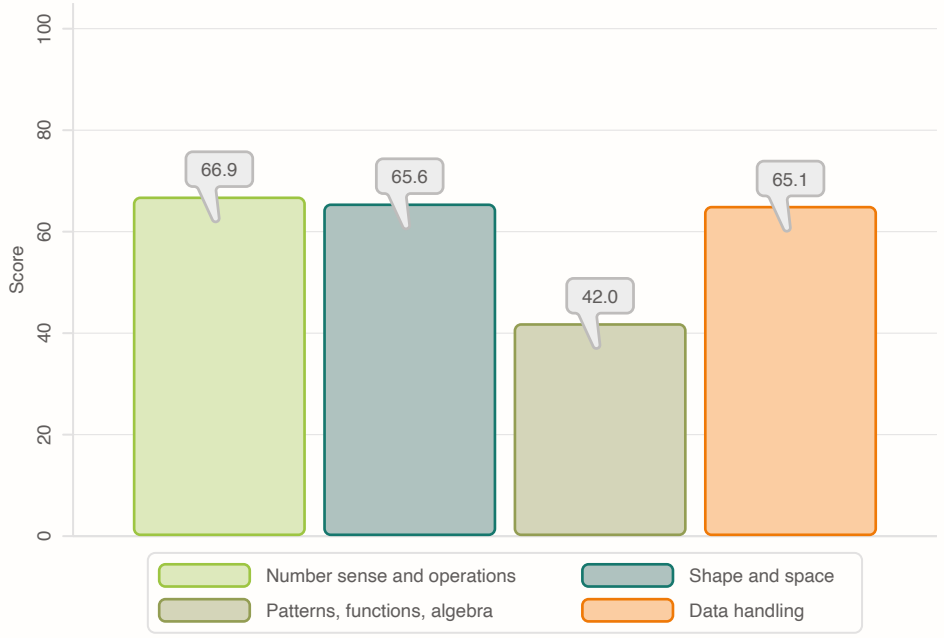
Figure 9: Performance on the sub-domains of the literacy sub-scale of ELOM 6&7



Observations: 440

Figure 10 shows performance on the different domains of the mathematics sub-scale of the ELOM 6&7 assessment. Learners scored worst on the mathematics sub-scale than the literacy sub-scale on average, and did particularly poorly in patterns, functions and algebra, scoring only 42.0 points. Learners scored similarly across the remaining three domains of the mathematics assessment.

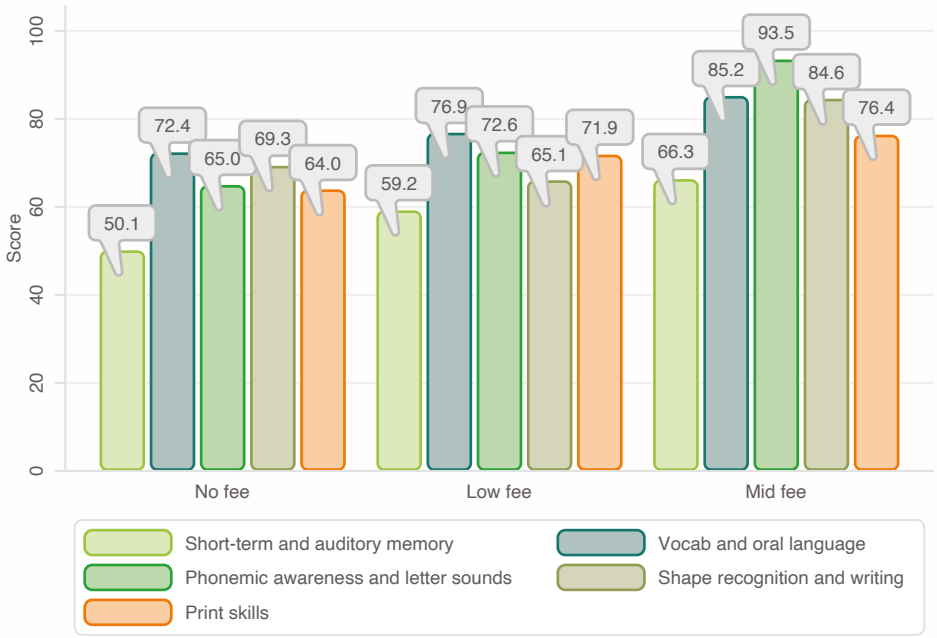
Figure 10: Performance on sub-domains of the mathematics subscale of ELOM 6&7



Observations: 440

Differences in scores on the literacy domains by school type are shown in Figure 11. It is interesting to note that learners in mid-fee schools performed best in phonemic awareness and letter sounds, a pattern that was not present among learners in no-fee and low-fee schools. A possible explanation could be that these are skills that are explicitly taught in the classroom, and as such one might expect larger gains in this domain in better quality schools. This result is explored further in the multivariate analysis.

Figure 11: Performance on the domains of the literacy sub-scale, by school fee group



Observations: 327 No-fee, 64 Low-fee, 49 Mid-fee

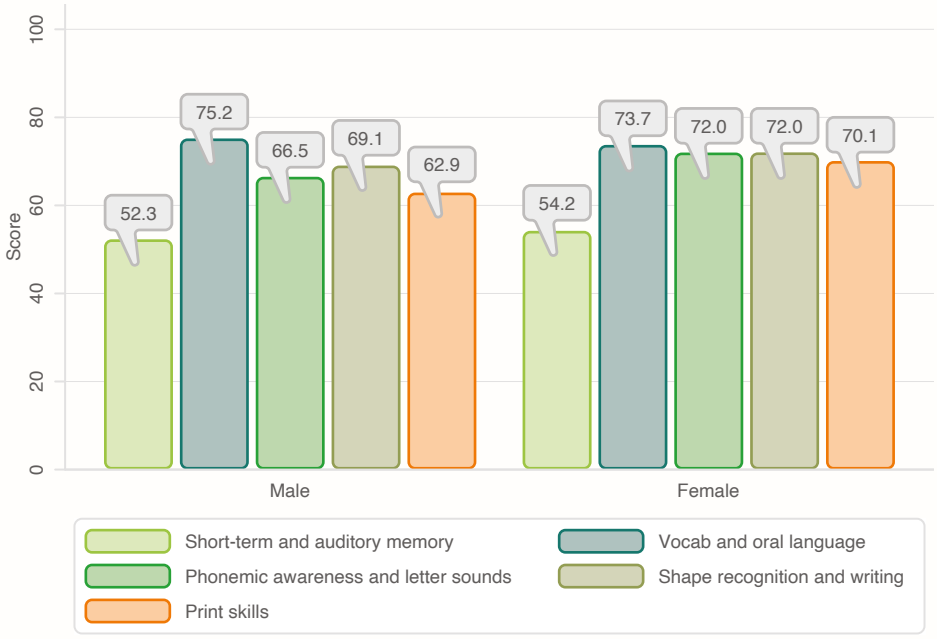
Differences in the domains of the mathematics subscale are shown in Figure 12. There were no clear differences in the patterns of performance across domains between different types of schools. Interestingly, learners in mid-fee schools performed worse in shape and space than number sense and operations, a pattern that was not present among learners in no-fee and low-fee schools.

Figure 12: Performance on the domains of the mathematics sub-scale, by school fee group

Observations: 327 No-fee, 64 Low-fee, 49 Mid-fee

Figure 13 shows performance on the domains of the literacy sub-scale by sex. Boys and girls performed fairly similarly across domains, with the exception of print skills, where girls outperformed boys by 7.2 points. This difference is statistically significant at 95%.

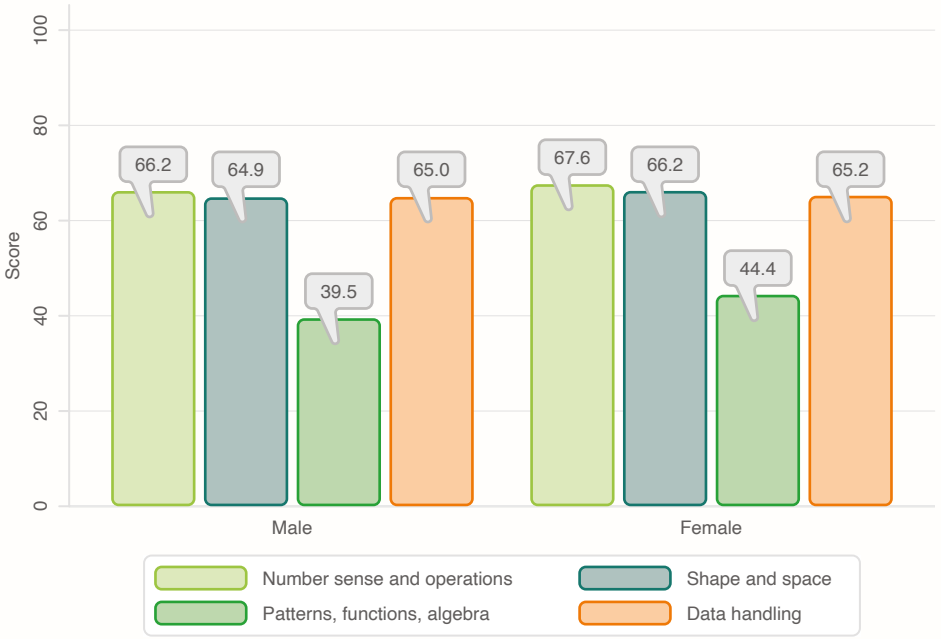
Figure 13: Performance on the domains of the literacy sub-scale, by sex



Observations: 219 Male, 221 Female

The performance of males and females on the domains that make up the mathematics sub-scale is shown in Figure 14. The figure shows that males and females performed very similarly in all four domains.

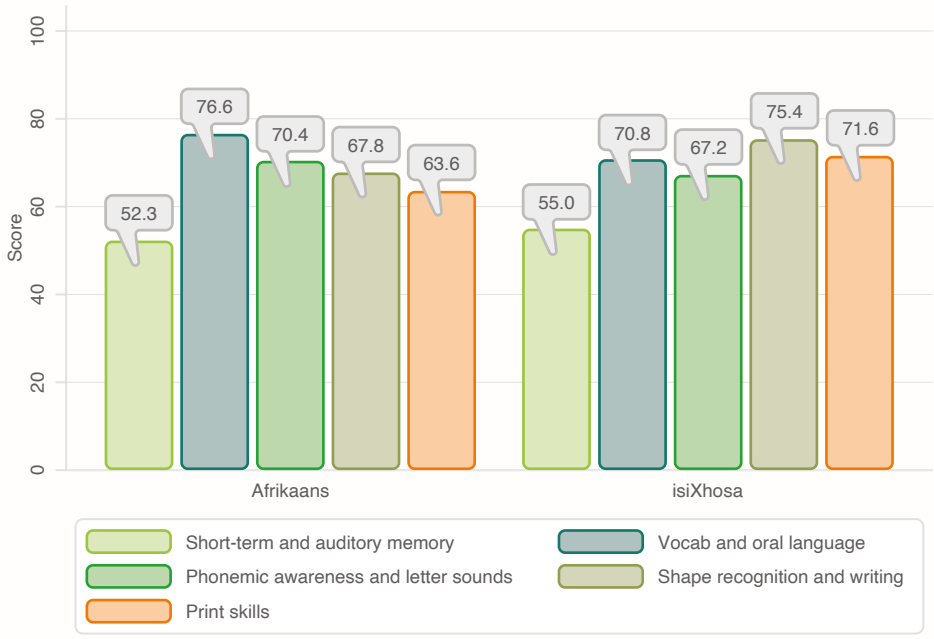
Figure 14: Performance on the domains of the mathematics sub-scale, by sex



Observations: 219 Marle, 221 Female

Language differences in performance in literacy domains are shown in Figure 15. Interestingly, Afrikaans learners performed best in vocabulary and oral language, while isiXhosa learners performed best in shape recognition and writing. isiXhosa learners also performed significantly better in print skills.

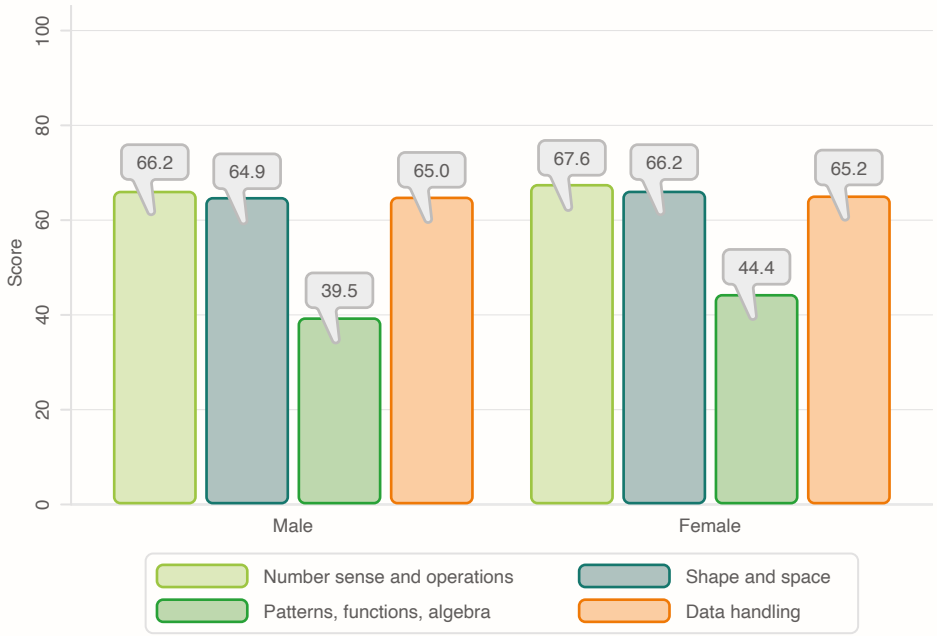
Figure 15: Performance on the domains of the literacy sub-scale, by language



Observations: 279 Afrikaaans, 181 isiXhosa

Figure 16 shows performance on the mathematics domains by language. The figure indicates that there were no significant language differences in performance on the domains, although isiXhosa learners performed slightly better in patterns, functions and algebra.

Figure 16: Performance on the domains of the mathematics sub-scale, by language

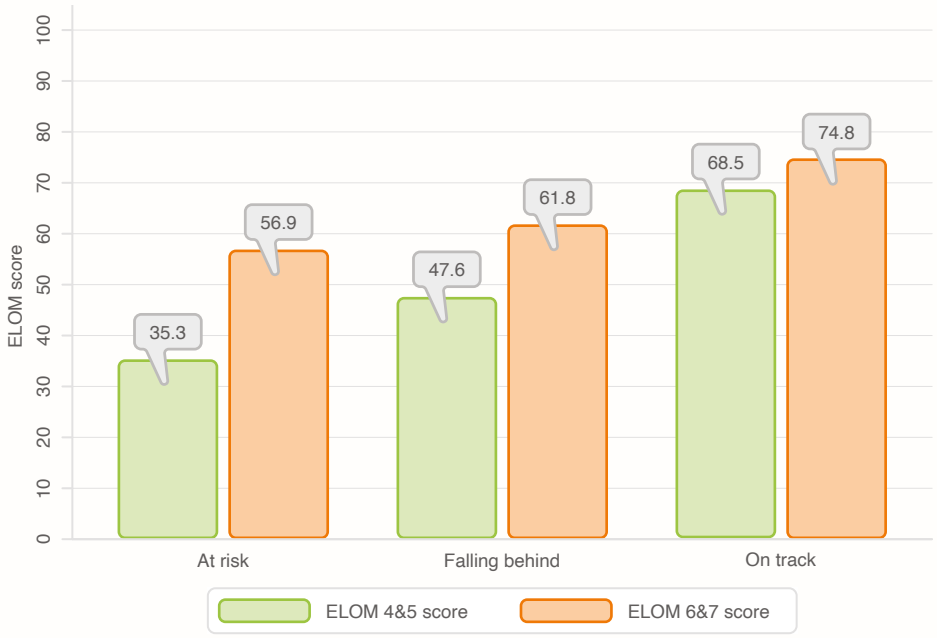


Observations: 279 Afrikaans, 181 isiXhosa

3.2. Learning gains between Wave 1 and 2

Having looked at overall performance in ELOM 6&7, it is instructive to consider how performance changed between the two waves of assessment. Figure 17 shows the ELOM 4&5 (Wave 1) and ELOM 6&7 (Wave 2) scores by Wave 1 category. It is clear from the figure that learners who were falling far behind in Wave 1 experienced the largest gains in ELOM scores (21 points), while learners who were on-track in Wave 1 experienced the smallest gains (6.3 points). Encouragingly, this points to catch-up occurring among learners who were falling far behind in Wave 1. Indeed, the gap in ELOM scores between learners who were falling far behind and those who were on track decreased from 33.2 points in Wave 1 to 17.7 points in Wave 2. It must be kept in mind, however, that gains are easier to achieve off a low base, and that this might explain the larger gains experienced by learners who were falling far behind in Wave 1. Nonetheless, this result points to the importance of Grade R in preparing learners with developmental gaps for Grade 1.

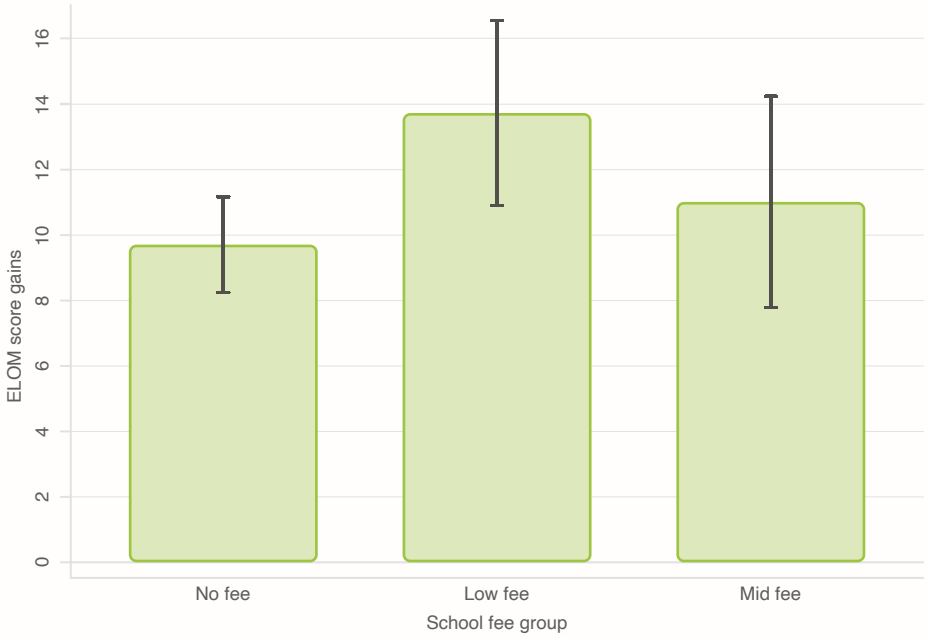
Figure 17: Performance in ELOM 4&5 versus 6&7, by Wave 1 category



Observations: 73 Failing far behind, 90 Failing behind, 277 On-track

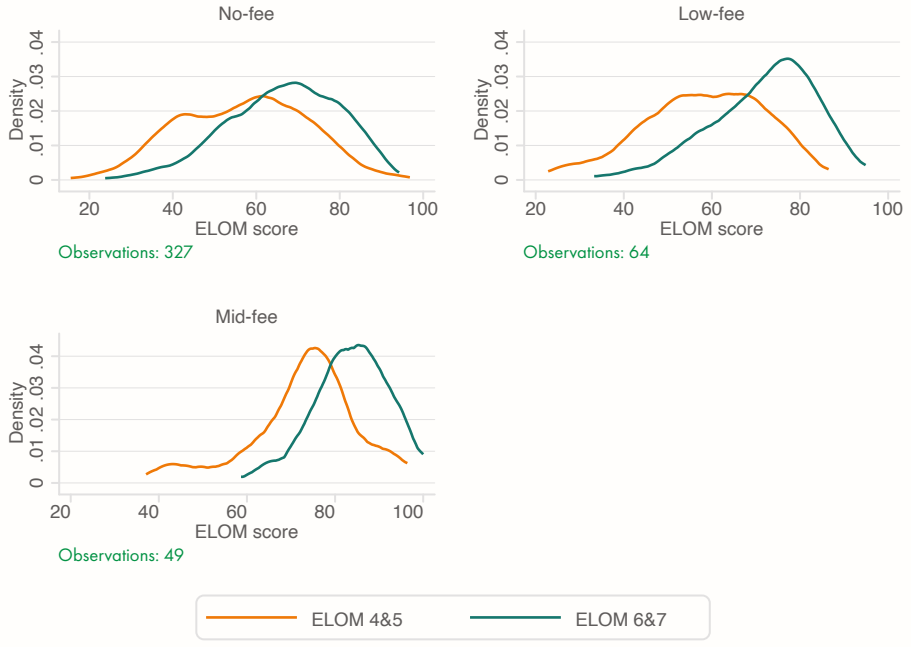
Figure 18 shows gains in ELOM scores between Wave 1 and Wave 2 by school fee group. The figure indicates that there were no statistically significant differences between different types of schools in the gains achieved between the two waves. It is important to note, however, that Figure 18 plots average gains, which may mask important differences in how the distribution of scores for the three groups of schools changed between the two waves of assessment. To investigate this, we plot the distributions of ELOM 4&5 and 6&7 scores for the three types of schools in Figure 19. The figure points to important differences in how the distribution of ELOM scores shifted for different school types between the two waves. While the distributions of scores in all three types of schools shifted to the right (indicating higher ELOM 6&7 than ELOM 4&5 scores), the clearest shift in distributions occurred in mid-fee schools. In these schools, the tail making up the lower end of the distribution in ELOM 4&5 disappeared in ELOM 6&7 scores, indicating that the lowest scorers in Wave 1 caught up to their peers. This same effect is not observable in either of the other two types of schools, with the distributions of ELOM 6&7 scores maintaining a clear tail of low-achievers in both no-fee and low-fee schools.

Figure 18: ELOM score gains by school fee group



Observations: 327 No-fee, 64 Low-fee, 49 Mid-fee

Figure 19: Distributions of scores in ELOM 4&5 and 6&7, by school fee group



Further considering gains between the two waves, Figure 20 shows gains between the waves by sex. It is clear from the figure that there were no sex differences in the gains achieved between the two waves of assessment. Figure 21 shows changes in the distribution of ELOM scores between the two waves for males and females, and indicates that there were no sex differences in how these distributions changed.

Figure 20: ELOM score gains by sex

Observations: 219 Male, 221 Female

Figure 21: Distributions of scores in ELOM 4&5 and 6&7, by sex

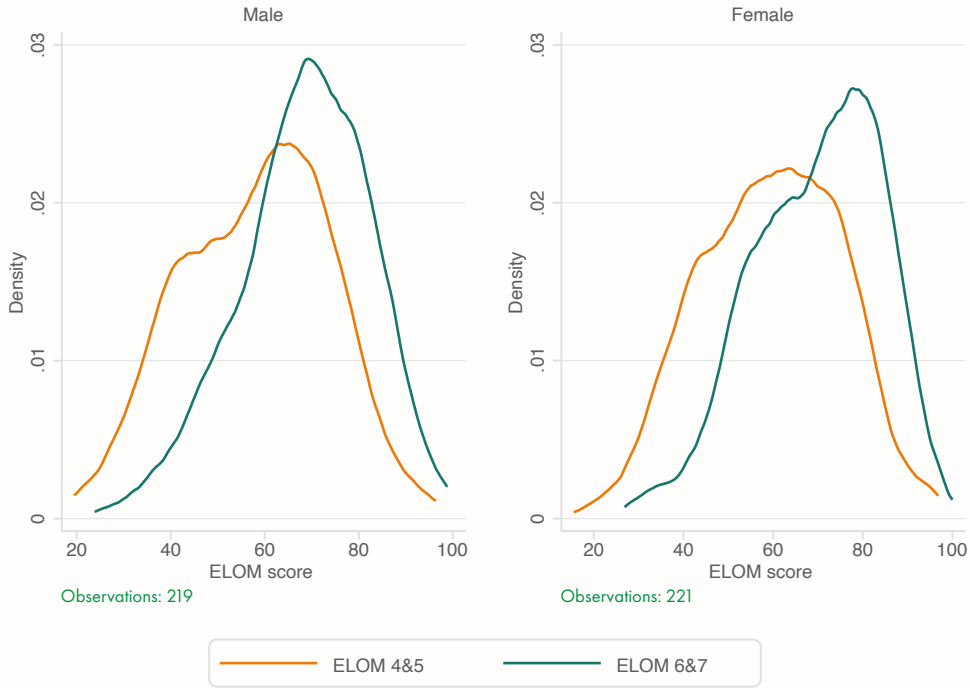
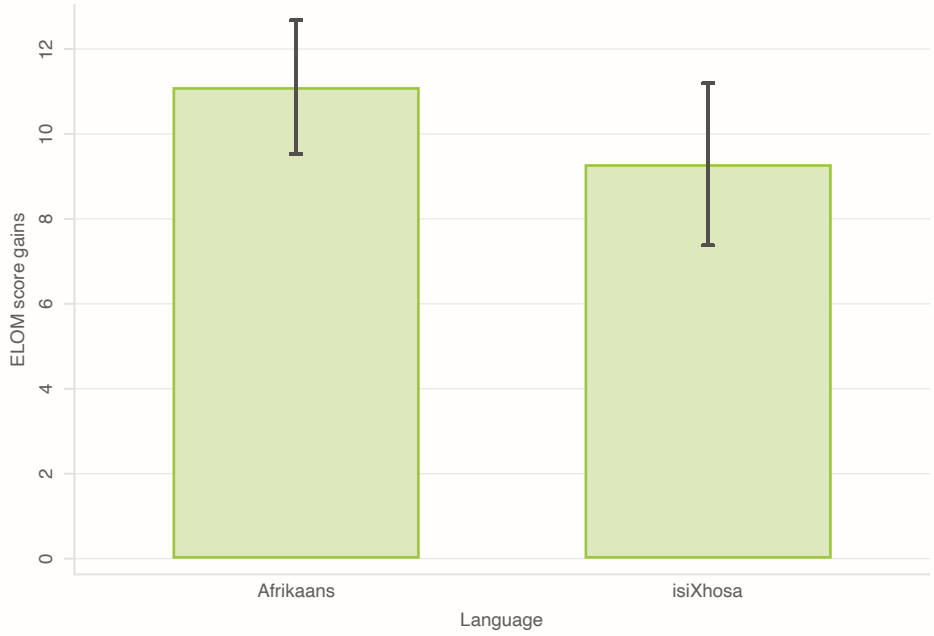


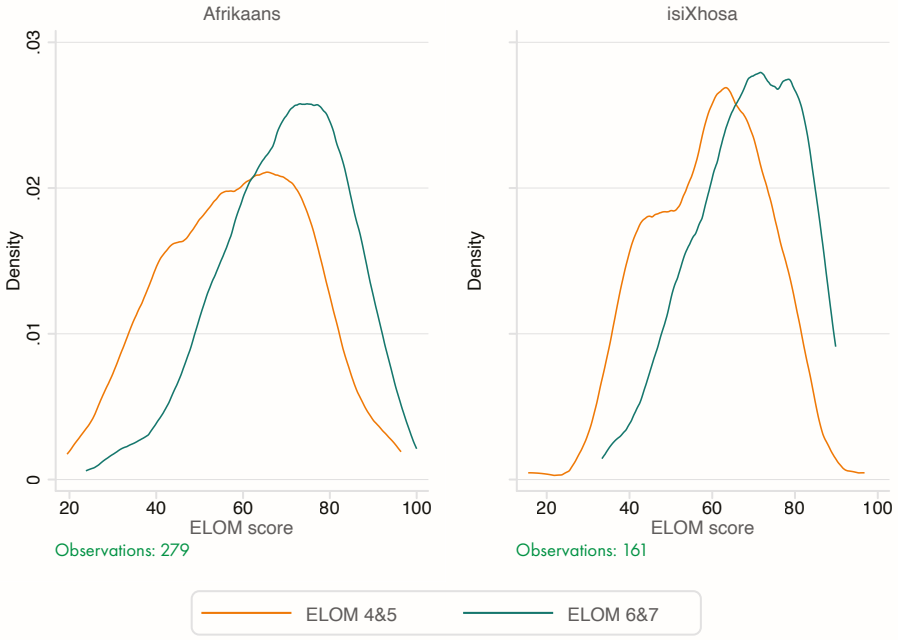
Figure 22 shows ELOM score gains by language and indicates that while Afrikaans learners gained slightly more points between the two waves, this difference was not statistically significant. Figure 23 considers the distribution of scores between the two waves by language, and indicates that here, too, we do not see significant differences in how the distribution of scores changed.

Figure 22: ELOM score gains by language



Observations: 279 Afrikaans, 161 isiXhosa

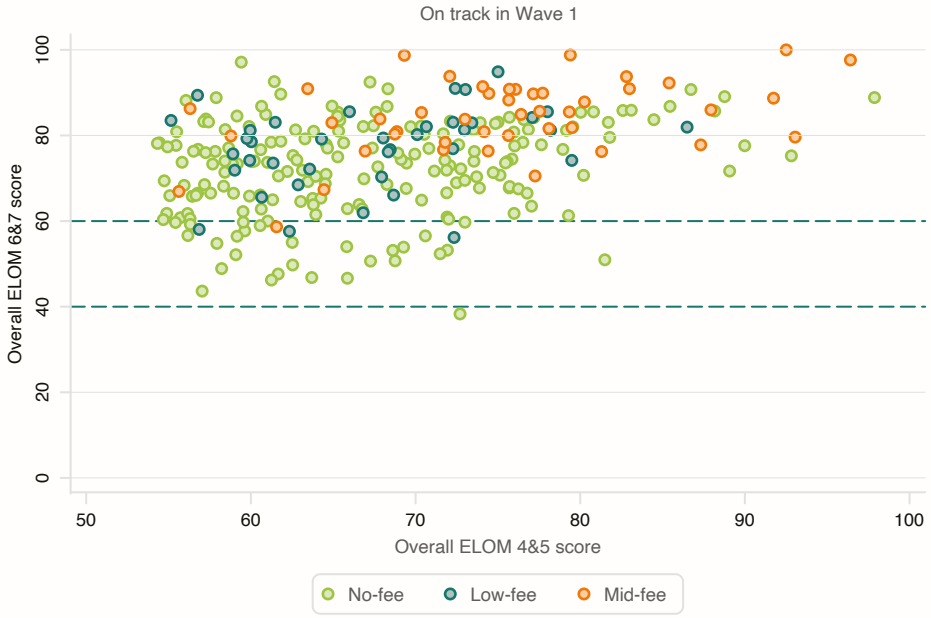
Figure 23: Distributions of scores in ELOM 4&5 and 6&7, by language



3.3. Movement between categories

Following from the result obtained in the first wave of assessment that there was a surprisingly high number of learners from no-fee schools who were on track developmentally, a key question arising from the first wave was what happens to these learners as they progress through school. Do they stay on track, or do their scores converge to the average performance of their schools? We attempt to answer this question by investigating the association between Wave 1 and Wave 2 scores for learners who were on track in Wave 1, shown in Figure 24. Each dot represents one learner, and learners in no-fee schools are indicated in light green, those in low-fee schools in dark green, and those in mid-fee schools in yellow. The dashed lines represent the cut-off points for Wave 2 school readiness categories. The figure shows that the vast majority (87.5%) of learners in no-fee and low-fee schools who were on track in Wave 1 were still on track in Wave 2. However, this still means that 12.5% of learners (29 learners out of 232) in no-fee or low-fee schools who were on-track in Wave 1 fell behind developmentally during the Grade R year.

Figure 24: Association between ELOM 4&5 and 6&7 scores

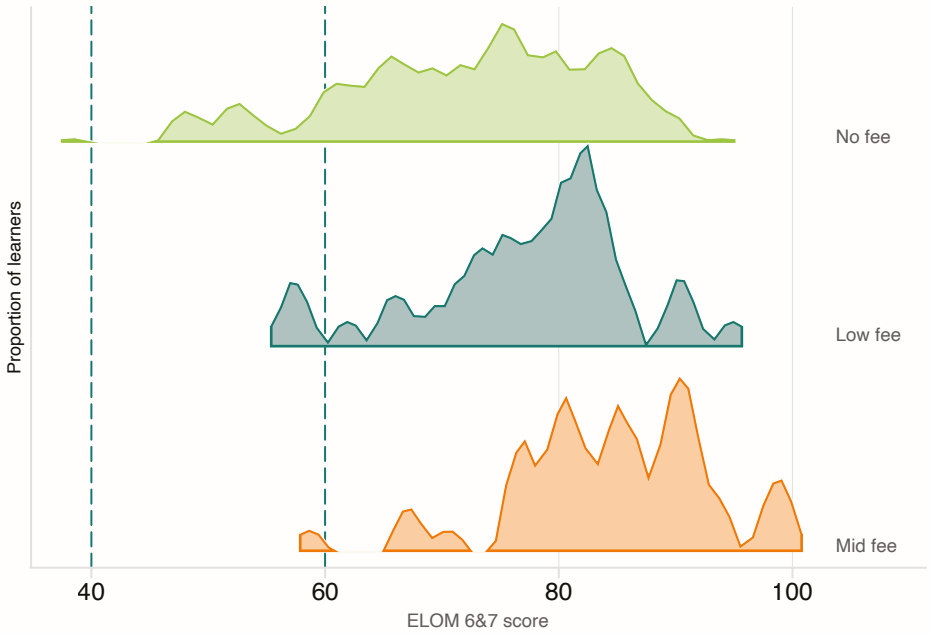


Observations: 277

Another way to consider what happened to the scores of learners who were on track in Wave 1 is to show their distribution of Wave 2 scores, as in Figure 25. The figure shows how ELOM 6&7 scores were distributed across different types of schools, again considering only learners who were on track in Wave 1. The dashed lines indicate the cut-off points for the different categories of ELOM 6&7 scores. While there is considerable overlap in the distributions of ELOM 6&7 scores of learners in different types of schools, the figure points to the development of a "tail" in the distribution of scores of learners in no-fee schools which is largely absent in low-fee and mid-fee schools. This tail is due to learners who were on track falling behind during the Grade R year, an effect that is concentrated in no-fee schools.

It is instructive to consider whether the learners who fell behind during Grade R were in the same schools. That is, was falling behind a phenomenon at the school level, or at the level of individual learners? Considering how learners who fell behind were distributed across schools shows that the 30 learners who fell behind were spread across 22 different schools. This suggests that falling behind was largely a learner-level phenomenon. That is, the evidence does not support the notion that overall school quality alone caused learners to fall behind. Rather, there were individual learners within schools who fell behind developmentally. Further research is needed to understand what made these learners fall behind their classmates.

Figure 25: Distribution of ELOM 6&7 scores for learners who were on track in Wave 1, by school fee group



Observations: 194 No-fee, 38 Low-fee, 45 Mid-fee
Notes: Score distributions only shown for learners who were on track in Wave 1

The answer to the question of what happened to on-track learners in no-fee and low-fee schools is therefore "it depends". The majority of these learners remained on track, but about one in ten (14%) fell behind during the Grade R year. Upcoming waves of the Roots and Shoots study will allow us to investigate what happens to these learners as they progress further through the schooling system.

3.4. Multivariate results

The analysis thus far has been limited to exploring differences in ELOM 6&7 scores across different categories of learners. We now extend this analysis by evaluating the associations presented thus far in a multivariate context. As socio-economic differences in ELOM 6&7 scores is of key importance, our main association of interest is that between school type and ELOM 6&7 scores. To investigate this, we make use of ordinary least squares (OLS) regression analysis to model the association between ELOM 6&7 scores and school type while controlling for a number of factors.

The first models consist of simple OLS regressions where the outcome variable is gains in ELOM scores between Wave 1 and Wave 2. Results are presented in Table 3. Model 1 includes only ELOM 4&5 scores as a control, while Model 2 includes other student-level characteristics as controls. The coefficients on low-fee and mid-fee indicate the difference in ELOM gains for learners in these types of schools relative to learners in no-fee schools. The coefficient on isiXhosa indicates the difference in gains between isiXhosa learners relative to Afrikaans learners.

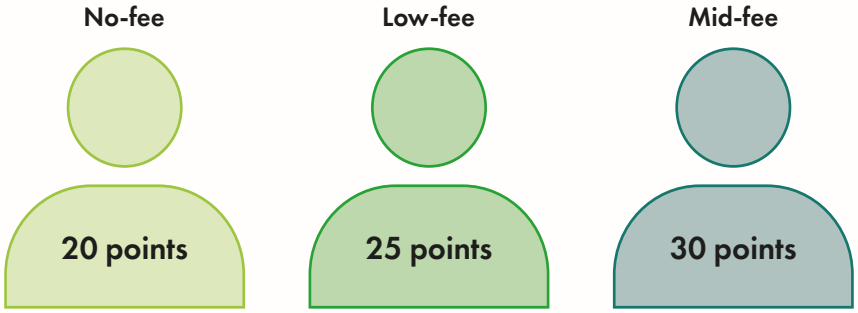
The results indicate that even when controlling for ELOM 4&5 scores, learners in low-fee and mid-fee schools experienced more gains than those in no-fee schools during Grade R. Controlling for other student-level factors, learners in low-fee schools gained on average 4.8 ELOM points more than those in no-fee schools, while those in mid-fee schools gained 10.3 points more than their counterparts in no-fee schools, on average. In other words, if one compared three learners with the same score in Wave 1 whom each attended a different type of school, the learner in the low-fee school learnt more during Grade R than the learner in the no-fee school, and the learner in the mid-fee school learnt more than both of the other two learners. Since learners in mid-fee schools were already at an advantage at the start of Grade R, the fact that they learnt more during Grade R points to a widening gap between learners from more advantaged schools and their counterparts in less advantaged schools.

Table 3: Regression results: Models 1 & 2

	Model 1	Model 2
Low-fee	4.678*	4.846**
	(2.052)	(1.482)
Mid-fee	9.545***	10.271***
	(1.848)	(1.809)
ELOM 4&5 score	-0.517***	-0.535***
	(0.041)	(0.035)
Age in Wave 1		0.212
		(0.190)
Female		0.684
		(1.010)
Repeated Grade R		-3.130
		(2.078)
isiXhosa		0.846
		(1.122)
Constant	39.074***	24.846*
	(2.501)	(12.494)
R2	0.35	0.36
N	440	440

Notes: * p<0.05; ** p<0.01; *** p<0.001. Outcome variable = Gains in ELOM scores.

Say you compared three learners who all had the same score in Wave 1 and each attended a different type of school. If the learner in the no-fee school gained 20 points between Wave 1 and Wave 2, the learner in the low-fee school gained 25 points, and the learner in the mid-fee school gained 30 points.



Given the result presented in Figure 11 that there were differences in the domain scores making up the ELOM 6&7 assessment across different types of schools, we next consider specific domains and how they are associated with being in a different type of school. To do so, we model the scores on each of the domains constituting the ELOM 6&7 tool as functions of school type, controlling for the same factors as the regressions in Models 1 and 2. Results for the literacy domains are presented in Table 4. It is important to note that the outcome variable in these models is not ELOM gains, but rather scores (out of 100) on each of the different domains. As was the case with overall ELOM 6&7 scores, learners in low-fee and mid-fee schools outperformed learners in no-fee schools across almost all the literacy domains, even when controlling for a number of learner-level factors. Interestingly, learners in low-fee schools did no better than those in no-fee schools in vocabulary and oral language and shape recognition and writing. By contrast, learners in mid-fee schools outperformed those in no-fee schools in all domains except print skills. The largest difference between learners in no-fee and mid-fee schools occurred in phonemic awareness and letter sounds, where learners in mid-fee schools scored 16 points higher than those in no-fee schools, on average. This echoes the result that learners in mid-fee schools learned more especially on the domains that are explicitly taught in the classroom.

It is interesting to note that the coefficients on female become significant in these models, with girls outperforming boys in both phonemic awareness and letter sounds and print skills, all other factors being constant. Language also becomes significant in these models, with isiXhosa learners scoring higher than Afrikaans learners in short-term and auditory memory, shape recognition and writing, and print skills. By contrast, Afrikaans learners performed better in vocabulary and oral language. Since the models control for ELOM 4&5 scores, these results suggest that Afrikaans and isiXhosa Grade R teachers focus on different skills, something that deserves further investigation.

Table 4: Regression results: Literacy domains

	Short-term & auditory memory	Vocab & oral language	Phonemic awareness & letter sounds	Shape recognition & writing	Print skills
Low-fee	10.164*** (2.677)	2.841 (1.653)	6.837* (3.256)	-1.310 (2.302)	9.944** (3.129)
Mid-Fee	12.516*** (3.267)	6.472** (2.018)	15.957*** (3.975)	12.385*** (2.810)	7.024 (3.820)
ELOM 4&5 score	0.402*** (0.064)	0.273*** (0.039)	0.777*** (0.077)	0.448*** (0.055)	0.618*** (0.074)
Age in Wave 1 (months)	0.148 (0.344)	0.025 (0.212)	0.604 (0.418)	0.111 (0.296)	-0.005 (0.402)
Female	1.103 (1.824)	-1.567 (1.126)	4.393* (2.219)	1.813 (1.569)	5.914** (2.132)
Repeated Grade R	-2.849 (3.754)	0.253 (2.318)	4.733 (4.566)	-3.971 (3.228)	-1.675 (4.388)
isiXhosa	5.858** (2.026)	-4.372*** (1.251)	-0.439 (2.464)	9.247*** (1.742)	9.711*** (2.368)
Constant	8.785 (22.565)	62.385*** (13.934)	-20.543 (27.449)	22.521 (19.406)	12.182 (26.380)
R2	0.18	0.21	0.30	0.27	0.23
N	440	440	440	440	440

Notes: * p<0.05; ** p<0.01; *** p<0.001. Outcome variables = ELOM 6&7 scores on each domain.

Table 5 presents the results for the mathematics domains of the ELOM 6&7 instrument. Learners in both low-fee and mid-fee schools outperformed learners in no-fee schools in three out of four domains. Interestingly, learners in low-fee schools did not outperform learners in no-fee schools in data handling, and learners in mid-fee schools did not outperform learners in no-fee schools in shape and space. Since shape and space is a very small part of the Grade R curriculum, this again supports the notion that learning gaps between learners in different types of schools were largest for the topics emphasised in the classroom. The largest difference between learners in no-fee and both low-fee and mid-fee schools was observed for the patterns, functions and algebra domain. It is further interesting to note that neither the sex or language variables emerge as significant in any of the models of the mathematics domains. Having repeated Grade R emerges as significant for the first time, with repeaters scoring 8.8 points less on number sense and operations, on average, than learners who did not repeat Grade R.

Table 5: Regression results: Mathematics domains

	Number sense & operations	Shape & space	Patterns, functions, algebra	Data handling
Low-fee	4.531* (2.065)	5.801* (2.329)	8.936* (3.703)	3.182 (2.974)
Mid-fee	9.903*** (2.520)	2.835 (2.843)	15.640*** (4.521)	13.449*** (3.631)
ELOM 4&5 score	0.603*** (0.049)	0.384*** (0.055)	0.530*** (0.088)	0.481*** (0.071)
Age in Wave 1 (months)	0.217 (0.265)	-0.019 (0.299)	-0.143 (0.476)	0.878* (0.382)
Female	0.478 (1.407)	1.042 (1.587)	4.304 (2.524)	-0.488 (2.027)
Repeated Grade R	-8.785** (2.895)	-3.289 (3.267)	-5.556 (5.194)	1.300 (4.171)
isiXhosa	2.360 (1.563)	-2.616 (1.763)	0.192 (2.803)	-2.087 (2.251)
Constant	12.698 (17.405)	46.352* (19.637)	15.112 (31.221)	-19.482 (25.074)
R2	0.38	0.15	0.16	0.19
N	440	440	440	440

Notes: * p<0.05; ** p<0.01; *** p<0.001. Outcome variables = ELOM 6&7 scores on each domain.

Altogether, the multivariate results point to three main conclusions:

1. School type was highly predictive of the gains learners would achieve in ELOM scores during Grade R. Learners in low-fee schools gained more during Grade R than learners in no-fee schools, and learners in mid-fee schools gained more than both of these groups.
2. Gaps between learners in different types of schools are widening. Learners in mid-fee schools were already at an advantage at the start of Grade R and learned more during Grade R.

3. Summary of main results

There is evidence of catch-up among learners who were falling furthest behind at the start of Grade R. Learners with the largest developmental gaps experienced the largest learning gains during Grade R, and the size of the gap between the scores of learners who were falling far behind and those who were on track developmentally halved between Wave 1 and Wave 2. This result is encouraging as it points to the importance of Grade R in reducing developmental gaps in children and preparing them for Grade 1.

There are clear socio-economic disparities in school readiness at the start of Grade 1. Learners in no-fee and low-fee schools scored lower on the ELOM 6&7 assessment than learners in mid-fee schools. While school fee status is not a perfect measure of socio-economic status, this nonetheless indicates that learners from different socio-economic backgrounds start Grade 1 at different levels of school readiness, with learners from more disadvantaged backgrounds falling behind those from wealthier backgrounds.

Learners in mid-fee schools learned more during Grade R than those in no-fee and low-fee schools. This results is obtained even when controlling for a number of factors at the student level, including scores at the start of Grade R. It suggests that if one compares three learners with the same score at the start of Grade R who each attend a different type of school, the learner in the low-fee school will learn more than the learner in the no-fee school, and the learner in the mid-fee school will learn more than both of the other two.

Gaps in development outcomes widened during Grade R. Since learners in mid-fee schools both started Grade R at an advantage and learned more during Grade R, the gaps between learners from socio-economic backgrounds widened between the two waves of assessment. This points to the cumulative effect of socio-economic disadvantage over learners' school careers – learners from more disadvantaged backgrounds both start school at a disadvantage and learn less during Grade R.

There is much variation within schools in the learning gains achieved during Grade R. While the fee-charging status of schools was highly predictive of gains during Grade R, there is evidence of much variation within schools, with some learners in no-fee schools gaining little during Grade R, and some even falling behind, while others experienced significant gains in ELOM scores. This suggests that within schools, individual learners are learning at different paces. It is likely that differences in home background inputs could explain why these learners achieved larger gains than their peers. Unfortunately, no home background information on the Roots and Shoots learners has been collected to date. The following waves of data collection will include caregiver surveys so that more information can be obtained about learners' home environments.

4. Conclusion

The second wave of the Roots & Shoots study introduces important evidence to our understanding of how developmental outcomes at the beginning of Grade R translate into school readiness at the beginning of Grade 1. Since it is the first study to follow the same learners from the beginning of Grade R to the beginning of Grade 1, we are for the first time able to show how socio-economic status is associated with how much children learn during Grade R. The results show that while some learners in no-fee and low-fee schools achieved significant gains in learning outcomes during the course of Grade R, on average learners in mid-fee schools learned more during Grade R than those in no-fee and low-fee schools. This result emerged even when controlling for learners' scores at start of school. This translates into widening gaps between learners from different socio-economic backgrounds, as learners from more advantaged backgrounds both arrived at school at an advantage and learned more during the Grade R year.

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