Innovation Edge Briefing Document

The Development and Age Validation of the Early Learning Outcomes Measure (ELOM)

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Purpose

An Early Learning Development Standards (ELDS) approach underpins the ELOM. ELDS are defined as: **what children of particular ages and stages should know and be able to do**. This approach permits the ELOM to be aligned with expectations for children's knowledge and capabilities that are expressed in South African Early Childhood Development (ECD) programming guidelines such as the National Early Learning Development Standards (NELDS) and National Curriculum Framework (NCF) for Children Birth to Four Years – all developed by the national Department of Basic Education.

The primary purpose of the ELOM is to:

> **Provide all types of early learning programmes with a psychometrically valid instrument for the assessment of children from all socio-economic backgrounds against the early learning standards that they are expected to reach prior to Grade R, and which will thereby provide evidence for the performance of early learning programmes.**

ELOM assessment findings point to programme areas that need to be strengthened in order for children to transition into, and have a good start in Grade R.

The ELOM is not:

- Intended as an instrument for assessing school readiness.
- A psychological test designed to assess intelligence or diagnose developmental delay, although it could be used to identify children who are significantly behind the standard expected for their age.

The ELOM is an affordable measure that does not take longer than 45 minutes to administer by experienced, trained ECD practitioners.

ELOM Age Groups

The ELOM is an age-normed standardised measure for use with children in two age groups: 50-59 months and 60-69 months. The division into younger and older age groups addresses the need for an instrument that takes into account the different levels of development expected of the older and younger children, and enables comparison with the expected performance of age peers.

ELOM Development

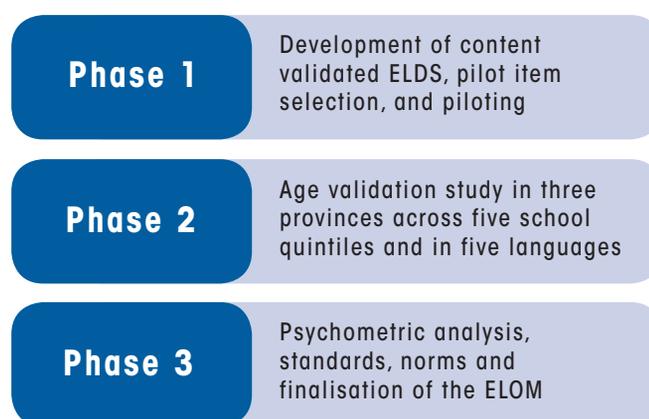The ELOM was developed in three phases as shown in Figure 1.

Phase 1 — Development of content validated ELDS, pilot item selection, and piloting

Phase 2 — Age validation study in three provinces across five school quintiles and in five languages

Phase 3 — Psychometric analysis, standards, norms and finalisation of the ELOM

Figure 1 The Development of the ELOM

Phase 1 Development

Early Learning Development Standards and indicators for children eligible for entry to Grade R (turning 60 months prior to July in the year of admission) were sourced from research literature, policy documents and key stakeholders, including Grade R educators, officials and respected experts (both locally and internationally). Valid, reliable assessment items for measuring ELDS indicators that had been preferably tested for suitability in South and Southern Africa were scanned. These steps ensured the content validity of the ELOM.

The tool includes both Direct Assessment of children's performance and a Teacher Assessment of the child's social and emotional functioning and orientation to tasks. As these aspects of development cannot be adequately measured during a short direct assessment, this Teacher Assessment is intended to complement Direct Assessment by persons who are familiar with the child's behaviour over an extended period in the programme context.

The Pilot Phase was designed to test the performance of Direct Assessment ELOM items as well as administration procedures. Experienced preschool teachers were trained to administer the Direct Assessment ELOM in Afrikaans, English and isiXhosa in three schools. The Teacher Assessment was administered to children in two schools and its psychometric properties established. The performance of children on Direct Assessment ELOM pilot items was examined, adjustments were made, and additional items added where there were gaps in the instrument.

Phase 2 Age Validation

The post-pilot Direct Assessment ELOM used in the age validation study consisted of 24 items measuring indicators of the child's early development in six ELOM domains used internationally in exercises of this type:

1. Gross Motor Development [1]
2. Fine Motor Coordination and Visual Motor Integration
3. Emergent Numeracy and Mathematics
4. Cognition and Executive Functioning
5. Social and Emotional Development and Awareness
6. Emergent Literacy and Language

Task orientation was rated by the assessor during the testing session. Manuals for age validation were further translated into Setswana and isiZulu using accepted procedures to ensure linguistic and metric equivalence.

The goal was to construct a sample that was likely to be as representative as possible of children eligible to enter Grade R in January 2016, drawn from across South Africa's socio-economic distribution, and including five major language groups. The study to validate the ELOM and construct norms was conducted within the first five weeks of the school year so that children's exposure to Grade R learning would be minimal. The sample included Setswana speaking children from North West Province (Matlosana and Tlokwe Education Districts), isiZulu speaking children in KwaZulu-Natal (Umlazi District), and Afrikaans, English and isiXhosa speakers in the Western Cape Province (Metro East District).

A two-stage clustered sample design was employed. In the first stage, and in each district, probability proportional to Grade R population size sampling was used to randomly select schools within each of the five school quintile bands. Two schools in traditional, more rural areas in each of North West and KwaZulu-Natal were recruited independent of this exercise, to explore the influence of more "traditional" approaches to child rearing. In the second stage, learners were selected within Grade R classes using simple random sampling.

Given these procedures, the ELOM has been validated on a sample that is very likely to be representative of the range of socio-economic backgrounds of South African children. While not representative for language, it includes the languages spoken by about 70% of the population. The standards and norms developed in this study are therefore also valid for children from these backgrounds.

In each province, field managers, senior assessors (in a supervisory role), and child assessors were appointed and trained in the Direct Assessment ELOM. Following training, satisfactory inter-assessor reliability was established. Between them, these teams assessed 1473 children drawn from 173 schools. Following inspection of the data, removal of duplicates, incomplete records, children with disabilities, and problematic records, 1331 children were included in psychometric analyses of the Direct Assessment ELOM.

Phase 3 Psychometric Analysis, Standards & Norms

As preliminary analyses showed that there was no difference in the performance of children in Quintiles 2 and 3, and Quintiles 4 and 5, these were merged for purposes of analysis as shown in Table 1.

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[1] Gross and Fine Motor Development are components of Physical Development but are treated separately in the ELOM.

Quintile	N
1 *	114 (8.56%)
2 & 3	756 (56.80%)
4 & 5	461 (34.64%)
Total	1331

* (including children from "traditional" rural backgrounds)

Table 1 Sample used for Psychometric Analyses

Accepted psychometric analyses were conducted. These included:

1. **Confirmatory Factor Analysis** to assess whether or not the allocation of items to ELOM domains was appropriate. Items designed to measure socio-emotional functioning (empathy and awareness of own feelings) were strongly correlated with items designed to measure Emergent Literacy and Language. This is likely to have been because the task required a similar level of expressive language and vocabulary as demanded in the Emergent Literacy and Language items. They were therefore integrated with that domain.

2. **Rasch Analysis**, to establish item difficulty, indicated that children of similar ability performed at the same level on the easier and more challenging items. Rasch also enabled the construction of standard scores used in the construction of ELOM standards and norms (below).

3. **Differential Item Functioning** analysis to establish whether equally able children in different socio-economic groups were able to perform in the same manner on the same items. Where this is not the case, the item is judged to discriminate unfairly against children from different backgrounds. All items were found to be satisfactory.

4. When constructing assessment instruments of this nature, there is understandable concern that cultural differences may influence the child's performance and that some items may discriminate unfairly between groups. Psychometric analyses demonstrated that ELOM domain performance is not affected by differences in economic background or traditional child-rearing conditions. The ELOM can therefore be said to provide a fair assessment of children's capabilities from the range of backgrounds measured.

In sum, psychometric analyses indicated that the Direct Assessment ELOM domains are internally consistent, valid measures of the constructs: the items discriminate reliably between more and less able children, and do not discriminate unfairly between children of different backgrounds.

Following the psychometric analysis, the *Social and Emotional Development and Awareness* domain was excluded as the items loaded on the language factor. Improvements were made to certain instructions, and improvements were made to African language usage in the Initial Sound Discrimination item. Some changes to scoring were also made. The Teacher Assessment that accompanies the ELOM covers the social relations and emotional functioning in areas relevant to school. The child's Task Orientation scale rated by the assessor during the assessment was modified by removing items that did not perform satisfactorily in the item analysis.

The final Direct Assessment ELOM, revised and ready for public release, has 23 items clustered in five equally weighted domains:

1. *Gross Motor Development*
2. *Fine Motor Coordination and Visual Motor Integration*
3. *Emergent Numeracy and Mathematics*
4. *Cognition and Executive Functioning*
5. *Emergent Literacy and Language*

Direct Assessment

- Gross Motor Development
- Fine Motor Coordination and Visual Motor Integration
- Emergent Numeracy and Mathematics
- Cognition and Executive Functioning
- Emergent Literacy and Language

Teacher and Direct Assessment

- Social and Emotional Development and Awareness
- Task Orientation (persistence, attention and concentration)

Teacher Assessment Only

- Self-care
- Social Relations (adults and peers)
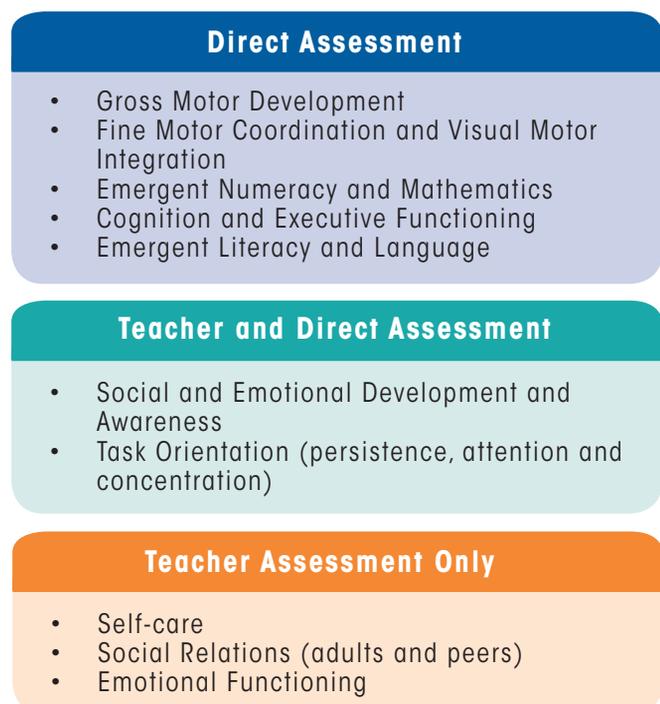- Emotional Functioning

Figure 2 What the Age Validated Standardised ELOM Measures

Construction of preliminary ELDS and ELOM norms

Standards are based on performance on the ELOM Direct Assessment. Those measured in the Teacher Assessment of the child are not included as they did not form part of the age validation process.

The process followed to set preliminary standards for Direct Assessment domains is outlined below. Rasch analysis transformed raw ELOM scores into standard scores (and z scores). As they are equally weighted, the transformation means that each domain contributes the same number of points to the Direct Assessment ELOM total (20 points each). In order to set ELDS using ELOM the raw scores of the total age validation study sample were converted to standard scores and plotted on a normal distribution around the median score – that achieved by 50% of the study sample.

Then standard score distributions were constructed for each of the three school quintile groups (1, 2&3, 4&5) to show their position on the distribution. These were then compared to establish the proportions of children in each who would meet a standard if it were set at a particular level. Distributions for the five domains were also constructed with school quintile group comparisons. The logic for preliminary ELDS standards based on ELOM performance proceeded thus:

1. Internationally, the advice of experts is that the ELDS should be set at a level of performance attained by a representative sample of 50 – 60% of children assessed. In the case of the ELOM study, that would be the **score** attained by at least 50% of the total sample (the median or middle score of the distribution). Children's performance on the ELOM provided information that could be used in this way.

2. As the ELOM is to be used to measure programme performance against a set of standards that children are expected to achieve, the sample median is regarded as too low. This is because it is depressed by 65% of the sample from disadvantaged backgrounds (Quintiles 1 to 3) attending "No Fee" Schools. We know from studies of the public school system, that children in these quintile bands perform below the level of those in Quintiles 4 and 5. This trend is also evident in the ELOM data.

3. To set the preliminary standards, the question asked was: what is the most appropriate and realistic reference point for setting expected ELDS for early learning programmes delivered to children affected by socio-economic disadvantage?

The ELOM study team are of the view that it is necessary to decide on a level of performance that can be realistically expected of early learning programmes while seeking to push toward an expected standard for children.

ELDS based on ELOM performance

Bearing these points in mind, the expected ELOM performance standards were benchmarked at *the standard score achieved by the top 40% of children in the age validation sample* (the 60th Percentile on the distribution). The benchmark was agreed at a consultation with stakeholders (including representatives from the Departments of Social Development, Basic Education and Planning, Monitoring and Evaluation in the Presidency), held in September 2016.

An illustration is provided in Figure 3 which uses the ELOM Total standard score for children aged 60-69 and 50-59 months. These scores range from 0-100 with a median of 50. In the Figure, the performance of children scoring in the top 40% of the distribution is used to illustrate the preliminary standard using a **solid black line** and **green zone**. School quintile group median scores are plotted on the graph for comparison purposes: Quintiles 4 and 5 in large dashes, Quintiles 2 and 3 in short dashes, and Quintile 1 in dot dashes. There is no difference between the top 40% and Quintiles 4 and 5 in this case. They tend to be close for each analysis. We have constructed performance bands based on percentiles as illustrated in Table 2. Children at risk are well below the standard and need significant assistance to come up to the standard, while those falling behind are closer to the standard, and with support they should be able to achieve it.

	50-59 Months			60-69 Months		
	At Risk	**Falling Behind**	**Achieving the Standard**	**At Risk**	**Falling Behind**	**Achieving the Standard**
Gross Motor Development	0 - 5.40	5.41 - 8.59	8.60 - 20	0 - 7.21	7.22 - 10.53	10.54 - 20
Fine Motor Coordination & Visual Motor Coordination	0 - 9.70	9.71 - 12.31	12.32 - 20	0 - 11.46	11.47 - 14.12	14.13 - 20
Emergent Numeracy & Mathematics	0 - 6.34	6.35 - 9.32	9.33 - 20	0 - 6.90	6.91 - 10.23	10.24 - 20
Cognition & Executive Functioning	0 - 4.07	4.08 - 7.16	7.17 - 20	0 - 5.84	5.85 - 9.26	9.27 - 20
Emergent Literacy & Language	0 - 6.53	6.54 - 10.25	10.26 - 20	0 - 7.97	7.98 - 11.64	11.65 - 20
ELOM TOTAL	0 - 36.01	36.02 - 46.31	46.32 - 100	0 - 43.23	43.24 - 54.37	54.38 - 100

Table 2 ELOM Standards and Performance Bands: ELOM Total and Domains

The approach illustrated in Figure 3 allows us to show empirically by how much early learning programmes have to improve children's performance in order to reach the standard. Illustrations of this type are provided for both age groups and all domains in the ELOM Technical Manual. Scoring protocols are also provided to the user so as to plot the child's position (or the average score of a group of children) on the distribution.
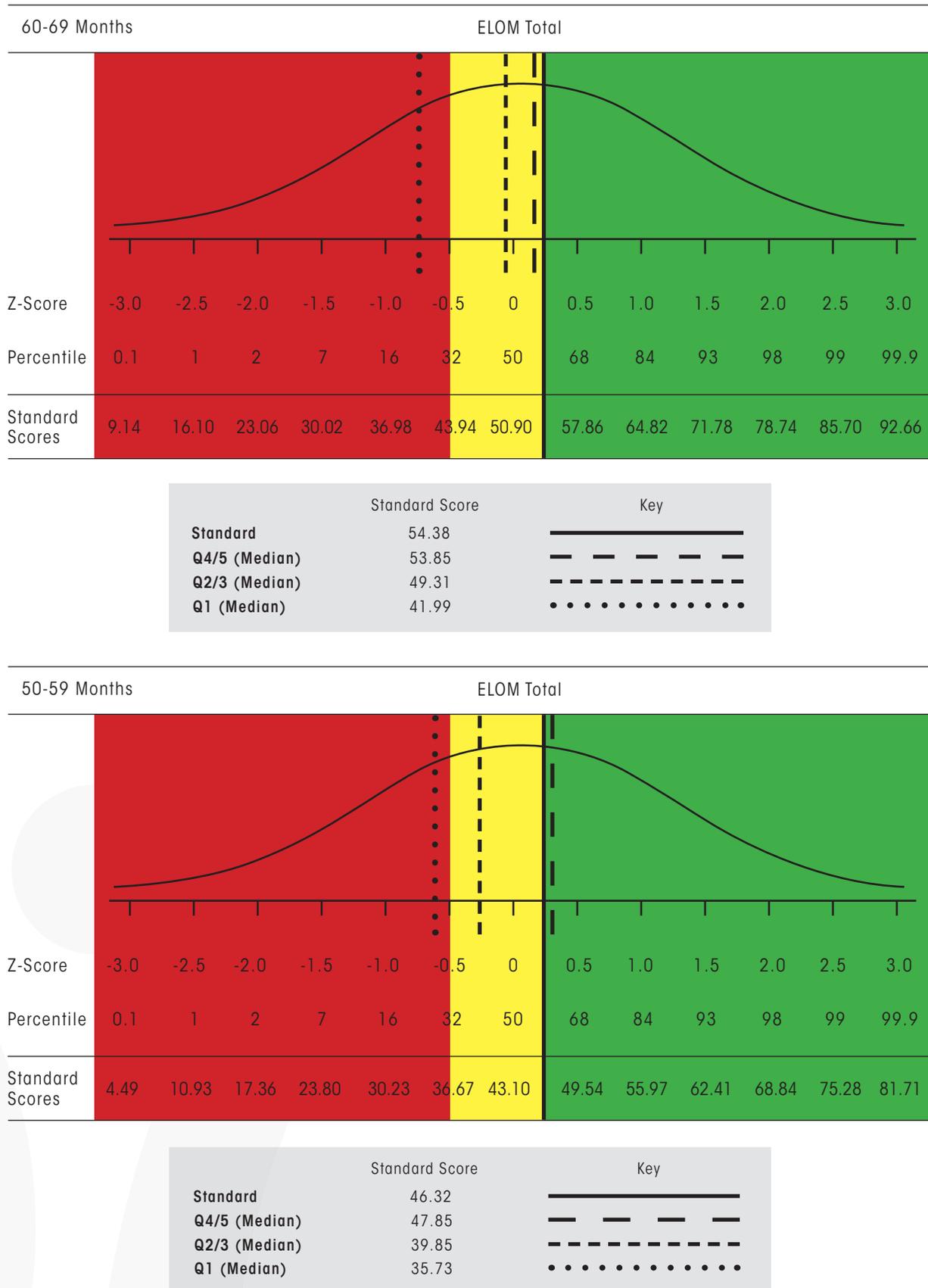
60-69 Months   ELOM Total

Z-Score	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0	0.5	1.0	1.5	2.0	2.5	3.0
Percentile	0.1	1	2	7	16	32	50	68	84	93	98	99	99.9
Standard Scores	9.14	16.10	23.06	30.02	36.98	43.94	50.90	57.86	64.82	71.78	78.74	85.70	92.66

	Standard Score	Key
Standard	54.38	———————
Q4/5 (Median)	53.85	— — — — —
Q2/3 (Median)	49.31	– – – – – – – –
Q1 (Median)	41.99	• • • • • • • • • •

50-59 Months   ELOM Total

Z-Score	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0	0.5	1.0	1.5	2.0	2.5	3.0
Percentile	0.1	1	2	7	16	32	50	68	84	93	98	99	99.9
Standard Scores	4.49	10.93	17.36	23.80	30.23	36.67	43.10	49.54	55.97	62.41	68.84	75.28	81.71

	Standard Score	Key
Standard	46.32	———————
Q4/5 (Median)	47.85	— — — — —
Q2/3 (Median)	39.85	– – – – – – – –
Q1 (Median)	35.73	• • • • • • • • • •

Figure 3 ELOM Standard Score Distributions for the Total Sample

When considering ECD programmes' potential to shift children's performance substantially on the ELOM, it is important to stress that children's home backgrounds contribute significantly to their performance on tasks of this nature, as is evident in the performance of Quintile 1.

While early learning interventions for the poorest children can improve outcomes significantly, unless they are of high quality and appropriate intensity, they are unlikely to fully compensate for the deficits in home backgrounds that are associated with significant deprivation and limited parental resources and education. Hence early learning programmes for children in Quintiles 1 – 3 would be demonstrating positive outcomes if they are able to shift the average performance of participating children toward the expected standards.

The question of how much of a positive shift is indicative of programme success is for donors and programmes to decide, but it should be realistic. We simply do not know, at this stage, the extent to which programmes are able to improve performance on the ELOM. But there is now the potential for programmes to be compared so as to determine the extent to which they are able to improve performance – an exciting possibility for the future.

ELOM Outputs include:

1. ELOM Briefing Report (this document)
2. ELOM Direct Assessment Manuals in English, isiXhosa, isiZulu, Setswana, Afrikaans
3. ELOM Technical Manual (including psychometry, standards, score interpretation)
4. ELOM Direct Assessment Kits, Tablets and Paper scoresheets
5. ELOM Teacher Assessment of the Child

Key Next Steps

1. Prior to its release, a protocol for training and accreditation of assessors must be agreed by the Innovation Edge.

2. Similarly, decisions will need to be made regarding the purchase of the ELOM kit and programmed tablets.

3. It is recommended that guidelines for programme improvement be developed for those using the ELOM to measure programme performance.

4. Possible future research on the ELOM:

    a. A predictive validity study of the ELOM in a sample of children from each quintile who participated in the age validation

    b. Comparative studies to establish which programmes improve early learning outcomes as assessed on the ELOM

    c. A study of children in Quintile 5 to examine what performance is possible for the most advantaged children

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early learning outcomes measure