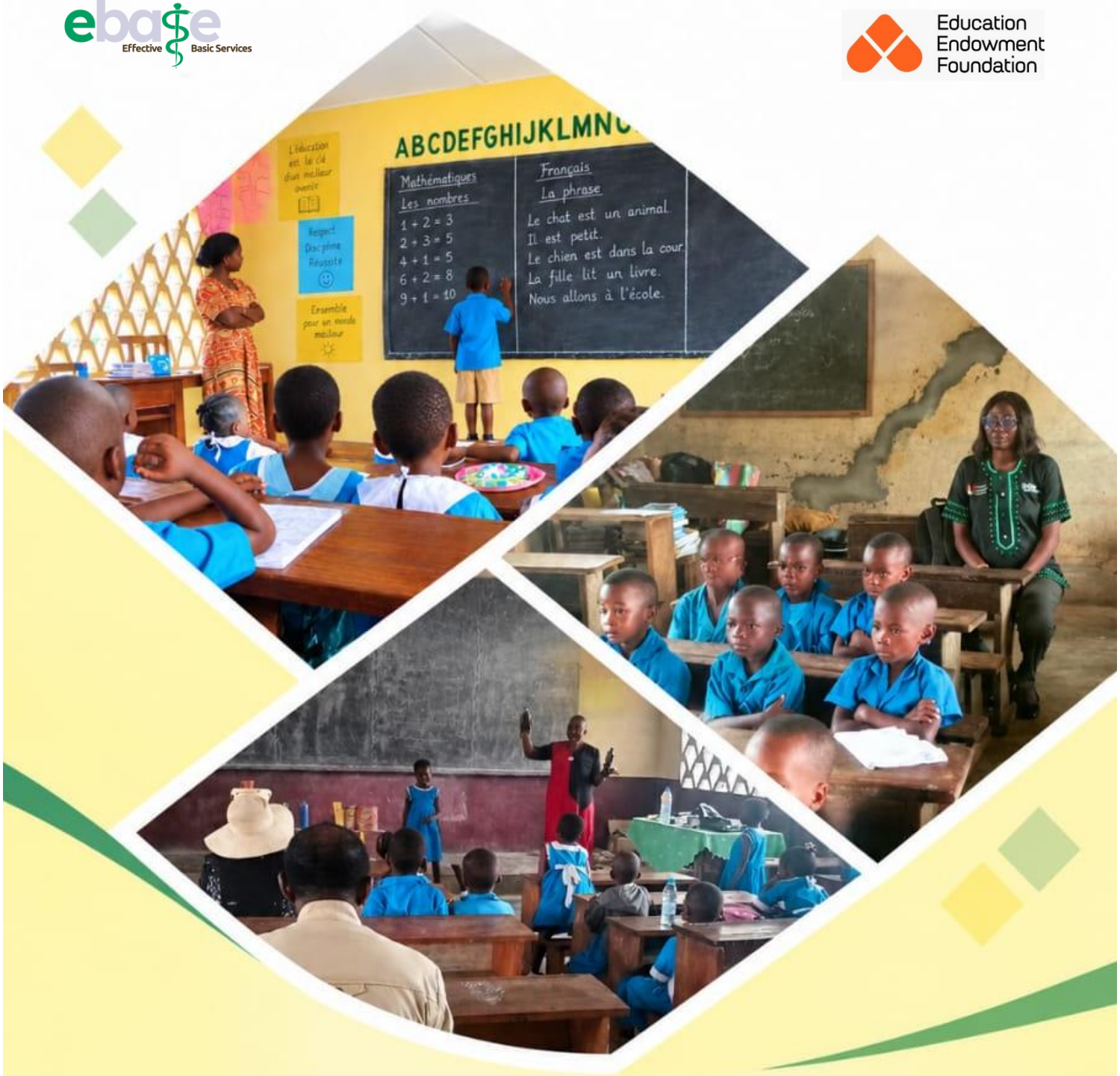

Metacognition and Self-Regulated Learning

Report

Project funded by the Education Endowment Foundation (EEF)

LEARNING REPORT

Metacognition and Self-Regulated Learning (SRL) in Limbe II Subdivision, South West Region, Cameroon

A report on the implementation of metacognitive and self-regulated learning strategies in five public primary schools, prepared for project partners

Effective Basic Services (eBASE) Africa

Bamenda, North West Region, Cameroon

Executive Summary

The Metacognition and Self-Regulated Learning (SRL) project in Limbe II Subdivision, Cameroon, aimed to strengthen foundational Mathematics teaching by helping learners plan, monitor and evaluate their work. Teachers were supported to use explicit modelling, goal setting, questioning, guided practice, reflection and self-assessment so that learners could become more aware of how they approach mathematical tasks. The pilot examined how these strategies were implemented in five public primary schools and how observed teaching practices and learner numeracy results changed over the implementation year. Evidence from international research provided a rationale for testing the approach locally, but the findings in this report relate only to the participating schools.

The pilot involved ten Primary One and Primary Two teachers and a target population of 359 learners across five purposively selected schools in Limbe II. It used a mixed-methods implementation-evaluation approach, combining a 58-item classroom audit, direct administration of the same standardised numeracy test in the first, second and third terms, and stakeholder feedback sessions involving teachers, headteachers and pedagogic officials. There was no comparison group. Both the Metacognition and Self-Regulated Learning and Mastery Learning trainings took place after the baseline audit. The initial classroom audit therefore represents a pre-training baseline for the Metacognition and Self-Regulated Learning pilot. Learner assessment results were recorded at school and class level; learner-level scores and term-specific tested counts were not available for independent analysis.

One key finding concerned changes in observed teaching practices. By end line, all 58 audit indicators were rated between 80% and 100%, compared with a wider range of 0% to 100% at the initial audit; 54 indicators increased and four remained at 100%. The mean for the thematic group covering explicit metacognitive instruction rose from 24% at the initial audit to 92% at end line, while the planning, reflection and regulation group rose from 35% to 87.5%. Classroom dialogue and peer interaction increased from 51.4% to 94.3%. These are descriptive audit results: the initial audit followed training, the checklist includes both classroom practices and enabling conditions, and the changes cannot be attributed to the intervention alone.

Learner numeracy test success rates were higher in the third term than in the first term in all five schools. School-level rates rose by between 25 and 52 percentage points: for example, G.S. Ngeme increased from 42% to 94%, while G.S. Batoke increased from 60% to 87%. At class level, Primary One rose from 51.0% in the first term to 84.7% in the third term, and Primary Two from 54.7% to 83.0%. The second-term results were lower than first-term results in several schools and classes before rising in the third term. Because results were available only as school- and class-level summaries, these figures should not be combined into a single overall learner percentage or interpreted as verified individual learning gains. Regular instruction, learner maturation, attendance and familiarity with repeated testing may also have contributed to the observed pattern.

Stakeholder feedback described greater use of modelling, questioning, guided practice, reflection and opportunities for learners to evaluate their own work. Participants also identified practical constraints, including the time required to embed new practices, availability of teaching resources and the need for ongoing school-based support. The feedback suggests that implementation was possible in the participating schools, but the report does not contain a complete set of predefined quantitative

feasibility or acceptability measures, and the underlying feedback records were not available for independent re-analysis. The evidence therefore provides preliminary implementation insights rather than proof of effectiveness or readiness for large-scale adoption.

The report recommends continued professional development, regular school-based coaching and mentoring, peer collaboration, and the integration of metacognition and self-regulated learning into pre-service and in-service teacher education. Future implementation should preserve item-level audit scores, learner-level anonymised assessment data, term-specific denominators and a documented analysis trail. A stronger evaluation design, including a suitable comparison strategy where feasible, would help distinguish changes associated with the approach from changes that might occur through ordinary teaching and other influences. Any expansion should be informed by verified outcome data and attention to the resources and time teachers need to sustain these practices.

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Introduction

1.1 Background

In Cameroon, regional learning assessments provide evidence about primary learners' performance in mathematics and language. PASEC2019, whose results were released in 2020, included Cameroon among 14 participating countries and assessed learners at the beginning and end of primary schooling (Programme d'Analyse des Systèmes Éducatifs de la CONFEMEN [PASEC], 2020). These regional results provide context for attention to foundational learning, but they do not by themselves establish the prevalence of any particular teaching method in the five schools included in this project. Sustained, subject-specific professional learning can support teachers to incorporate evidence-informed approaches into classroom practice. The project findings on the availability and consistency of such support are discussed in relation to the participating schools.

Metacognition refers to knowledge about and monitoring of one's own cognitive processes (Flavell, 1979). Self-regulated learning is broader and includes learners' active regulation of their cognition, motivation and behaviour in pursuit of learning goals (Pintrich, 2000; Zimmerman, 2002). In this project, the approaches included helping learners plan, monitor and evaluate their work through explicit modelling, prompts, reflection and self-assessment. The Education Endowment Foundation's 2018 guidance report summarised evidence suggesting that well-implemented metacognitive strategies could be associated with the equivalent of approximately seven additional months of progress; this is an evidence-synthesis estimate from other settings, not a forecast or result for this Cameroon project (Quigley et al., 2018).

Research has examined metacognition and self-regulated learning across educational contexts. Studies and reviews emphasise explicit instruction, modelling, subject-specific application and opportunities for guided practice (Schraw, 1998; Dignath & Veenman, 2021; Quigley et al., 2018). The strength and transferability of evidence vary by context and intervention. Accordingly, international findings provide a rationale for examining these strategies in Cameroon, but they do not substitute for local evidence about implementation or outcomes.

This report describes changes in observed teaching practices, implementation experiences and learners' numeracy test results across three terms. It also identifies reported barriers and enablers. Because the evaluation used a small purposive sample, there was no comparison group and the findings are based on five purposively selected schools, the findings document implementation and observed patterns of change; they do not establish a causal effect or demonstrate scalability.

Ultimately, the Metacognition and Self-Regulated Learning project aims to contribute to improving foundational numeracy in Cameroon, aligning with national education priorities. By addressing gaps in traditional teaching methods and fostering learner autonomy, the project holds the potential to inform meaningful educational practice in similar low-resource settings.

Purpose of the Report

2.1 Purpose

This report aims to provide a clear understanding of current teaching practices, challenges, and teacher readiness, in terms of beliefs, competencies and perceptions, for implementing metacognition and self-regulated learning in classrooms. The findings are intended to help shape the development of key components essential for the successful integration of metacognitive and self-regulated learning strategies into teaching and learning processes.

2.2 General Objective

To describe teaching practices, teacher readiness and classroom implementation of the metacognition and self-regulated learning approach in the participating schools, and to identify implementation challenges and enabling factors that can inform adaptation and future evaluation.

2.3 Specific Objectives

The objectives of this project were to:

- Assess the feasibility and acceptability of the Metacognition and Self-Regulated Learning project, focusing on its alignment with the project protocol.
- Describe teachers' perceptions of the usefulness of training and support, alongside changes in observed metacognitive and self-regulated learning practices.
- Examine teachers' attitudes and behaviours toward the use of metacognition and self-regulated learning approaches, identifying enablers and barriers to their adoption.

- Describe changes in learner numeracy test results across three direct administrations of the same standardised test, and examine observation and feedback evidence on learner engagement, problem-solving and autonomy.
- Assess the consistency and quality of metacognition and self-regulated learning implementation across classrooms.

2.4 General Research Question

How did observed teaching practices and learners' numeracy test results change over the project period, and what factors did participants identify as supporting or constraining implementation?

2.5 Specific Research Questions

- How has the feasibility and acceptability of the Metacognition and Self-Regulated Learning project influenced its implementation?
- How did teachers describe the usefulness of the training and support in helping them use metacognitive and self-regulated learning strategies in Mathematics lessons?
- To what extent have teachers' attitudes and behaviours toward metacognition and self-regulated learning changed over the course of the intervention, and what factors have sustained or hindered their use?
- What changes were recorded in learners' numeracy test results, and what evidence was available about learner engagement, problem-solving and autonomy during the project period?
- How consistently and effectively have metacognition and self-regulated learning strategies been integrated into classrooms during the intervention?

Evaluation Approach and Methodology

3.1 Evaluation Approach

The evaluation combined structured classroom audits, direct administration of the same standardised learner numeracy test and stakeholder feedback. Audit findings informed discussions about implementation and support. The approach drew on the general audit-and-feedback logic of evidence implementation; the cited JBI literature concerns healthcare and was adapted for this education pilot, rather than used as a validated education-specific protocol (Jordan et al., 2019).

- Structured classroom audits were conducted at the initial audit, midline and end line to record whether specified teaching practices were observed.
- Feedback discussions with pedagogic officials, headteachers and teachers were used to interpret audit findings, discuss implementation barriers and identify possible improvements.
- End-line findings were compared descriptively with earlier rounds to document changes and inform recommendations; the design does not support a definitive causal estimate.

- The same standardised numeracy test was administered directly to learners in the first, second and third terms of the implementation year, and its results were summarised descriptively by assessment round.

3.2 Research Design

A mixed-methods implementation evaluation was conducted. Quantitative evidence comprised classroom audit results and direct learner numeracy testing; qualitative evidence comprised stakeholder feedback. Learner outcomes were examined through a single-group repeated-assessment design using the same standardised test in all three terms. There was no random assignment or comparison group. The design describes change but cannot isolate the intervention's contribution from regular teaching, maturation, attendance, learner composition or familiarity with the repeated test.

3.3 Population of the Study

The report covers ten teachers and 359 learners enrolled in Primary One and Primary Two across five participating schools in Limbe II Subdivision. These are enrolment figures describing the project population; the number of learners tested in each school and class may differ by term, and tested counts were not available for this report. Findings are specific to the participating schools and are not statistically generalisable to all schools or learners in Cameroon.

Table 1: Summary of the target population of the study

S/N	School	Teachers	P1 boys	P1 girls	P1 total	P2 boys	P2 girls	P2 total
1	G.S. Wovia	2	8	7	15	7	8	15
2	G.S. Mokundange	2	32	37	69	31	38	69
3	I.G.P.S. Botaland	2	25	21	46	17	21	38
4	G.S. Ngeme	2	10	10	20	14	9	23
5	G.S. Batoke	2	10	19	29	20	15	35
	Total	**10**	**85**	**94**	**179**	**89**	**91**	**180**

Total teachers: 10. Total pupils: 359 (179 in Primary One; 180 in Primary Two). Grand total target population: 369, including teachers. This table presents the enrolment statistics for Primary One and Primary Two in the five participating schools, including a breakdown of teachers and pupils by gender.

3.4 Sampling Technique

Schools and teachers were purposively selected in the context of project participation and administrative access. Five schools participated, with ten Primary One and Primary Two teachers in total. This non-probability sample was suitable for documenting implementation in the selected sites

but is not statistically representative of the wider population. Pedagogic officials and headteachers also participated in feedback activities.

The sampling strategy focused on the following criteria:

- School selection: five primary schools in the Limbe II Subdivision were deliberately chosen based on their willingness to participate, accessibility, and representation of diverse school environments.
- Teacher selection: ten teachers (two per school) were purposively sampled from Primary One and Primary Two classes, as the project specifically targets foundational numeracy. Teachers were selected based on their roles in early-grade instruction and their potential to integrate metacognition and self-regulated learning principles into their teaching.
- Stakeholder involvement: pedagogic officials, headteachers and other education stakeholders were engaged in feedback sessions to provide a broader perspective on implementation challenges and strategies for improvement.

3.4.1 Selection of Respondents

The evaluation included ten participating Primary One and Primary Two teachers; and learners who took the numeracy test in the participating classes. Teachers, headteachers and pedagogic officials also contributed feedback. Teachers were purposively selected from participating schools. Learner outcome data were collected directly through numeracy test administration in Primary One and Primary Two.

3.5 Instruments for Data Collection

To ensure a comprehensive assessment of the project's association with Mathematics instruction and learner performance, the following data collection tools were used:

3.5.1 Audit Criteria Checklist

A 58-item structured checklist was used to record observable teaching practices and relevant enabling conditions associated with metacognition and self-regulated learning. Items covered planning, monitoring, evaluation, teacher modelling, guided and independent practice, classroom dialogue, feedback, professional learning and access to resources. Because these items span more than one construct, results are interpreted at item level and should not be treated as a single, validated measure of teacher competence. The checklist was reviewed and tried out before use, and the scoring guidance was refined. The full checklist is reproduced in Appendix 1.

- Adherence to metacognition and self-regulated learning principles.
- Frequency and variety of instructional strategies.
- Learner engagement and participation levels.
- Assessment and feedback practices employed by teachers.

Classroom observations covered all ten teachers in the five participating schools. Formal audit scoring was conducted by independent assessors who were separate from the personnel responsible for coaching or supporting teachers. Assessors were reported to be blinded to the audit stage and teachers' intervention exposure, and their role was limited to applying the audit criteria. Assessors

received guidance on the observation protocol and scoring definitions; calibration and independent scoring of a subset of observations were used to check consistency. Differences in ratings were reviewed against the scoring guidance.

3.5.2 Standardised Learner Numeracy Test

The same standardised learner numeracy test was administered directly to learners during the first, second and third terms. It assessed foundational numeracy relevant to Primary One and Primary Two. The assessment covered the following domains, matched to the Primary One and Primary Two Mathematics curriculum:

Domain	**What it measured**
Number identification	Reading and naming numbers (0-100)
Number comparison	Judging which of two numbers is larger or smaller
Missing number / patterns	Completing simple numeric sequences
Addition	Single-digit, and simple double-digit without regrouping for Primary Two
Subtraction	Single-digit, and simple double-digit without regrouping for Primary Two
Word problems	One-step addition/subtraction problems, presented orally to reduce reading literacy as a confounding factor

The assessment comprised 40 items: 10 number-identification items, five number-comparison items, five missing-number or pattern items, 10 addition items and 10 subtraction items; word problems formed a subset of the addition and subtraction items. Items were scored 1 for a correct response and 0 for an incorrect response, and scores were converted to percentages. Results were recorded and are reported as success rates at school and class level; learner-level and domain-level results are not reported. The assessment was administered orally, one-to-one, using common administration and scoring guidance. The items were reviewed and piloted before full implementation.

3.5.3 Repeated Numeracy Test Administration

Learner outcome data were collected directly by administering the same standardised numeracy test to learners in the first, second and third terms. Results were compared descriptively across rounds.

3.5.4 Stakeholder Feedback Sessions

Structured feedback discussions were held with teachers, headteachers, pedagogic officials and other relevant stakeholders to understand implementation experiences. Discussions covered perceived usefulness of the strategies, challenges encountered, examples of promising practice and possible adjustments. Feedback was reported as participants' experiences and perceptions.

3.6 Quantitative Data Collection

Quantitative data comprised the 58-item classroom audit checklist and results from three direct administrations of the same standardised learner numeracy test. Audit percentages describe the proportion of assessed teachers meeting each criterion. Learner numeracy results were recorded and are presented at school and class level; learner-level scores are not part of the data reported here, so no overall learner percentage is calculated. Counts, percentages and percentage-point changes are descriptive rather than causal estimates.

3.7 Qualitative Data Collection

Qualitative evidence came from feedback sessions with teachers, headteachers, pedagogic officials and other relevant stakeholders. Discussions explored implementation experiences, perceived changes in classroom practice, constraints such as time and class size, and suggestions for improving support. The findings are presented as stakeholder feedback and illustrative experiences.

3.8 Data Collection Procedure

The project used an audit-and-feedback cycle informed by general principles of the Joanna Briggs Institute evidence-implementation approach. The cited JBI publication describes a healthcare evidence-based practice model, so its use in primary education is a contextual adaptation rather than a validated education-specific protocol (Jordan et al., 2019). The procedure comprised an initial audit, discussion of findings and implementation support, followed by repeat audits.

Initial audit

Independent assessors used the 58-item checklist in the ten participating classrooms. They were separate from coaching personnel and were reported to be blinded to audit stage and intervention exposure. The same standardised learner numeracy test was administered directly to learners in the first term. Training preceded the initial classroom audit, so that audit is not a pre-training baseline.

Feedback and implementation support

Audit findings were reviewed to identify practices requiring additional attention. Feedback sessions with teachers, headteachers, pedagogic officials and other stakeholders provided an opportunity to discuss results and identify practical responses. Two pedagogic animators provided ongoing monitoring and follow-up support during implementation. This support role was separate from the independent assessors' formal audit-scoring role.

Follow-up audits

Independent assessors conducted midline and end-line classroom audits using the same checklist. The same standardised learner numeracy test was administered directly to learners again in the second and third terms. Audit findings and test results were compared descriptively across their respective rounds. These comparisons document observed change and do not establish causal effects.

3.9 Validity and Reliability

Validity and reliability were addressed through instrument review, standardised administration and scoring procedures, and checks on the consistency of the resulting data. The classroom audit checklist was mapped to the study's metacognition and self-regulated learning focus and reviewed for content relevance, clarity and observability. The checklist was tried out before the main data collection, and its

scoring guidance was refined to support consistent interpretation. The audit covered both observable instructional practices and enabling conditions; findings are therefore interpreted in relation to specific indicators rather than as a single, comprehensive measure of teacher competence.

To support consistency in classroom observations, assessors were oriented to the observation protocol and item-level scoring definitions and used the same checklist across the three audit rounds. Calibration and independent scoring of a subset of observations were used to check consistency between assessors, and identified differences were reviewed against the agreed definitions. Formal assessors were independent of the coaching/support function and were reported to be blinded to audit stage and intervention exposure. These safeguards do not remove limitations arising from the timing of the initial audit or the absence of a comparison group.

The learner numeracy test comprised 40 items covering foundational numeracy, with item review, piloting and scoring-consistency checks. The same standardised test was administered across all three terms using common administration and scoring guidance. This avoids differences in test form as an explanation for termly differences, although repeated exposure may create familiarity effects. Stakeholder feedback remains evidence of participants' experiences and perceptions, not independent proof of impact.

The report presents descriptive results and interprets changes over time cautiously. Instrument review and standardised procedures can strengthen measurement, but they cannot substitute for a comparison group or an uncontaminated pre-intervention baseline. The findings are interpreted as evidence about implementation and observed change in the participating schools, not as definitive causal estimates of intervention effectiveness.

3.10 Ethical Considerations

Ethical approval. The project protocol, Improving Foundational Literacy and Numeracy through Metacognition and Self-Regulated Learning (SRL) in Cameroon: Best Practice Implementation Project Protocol, received final expedited approval from the eBASE Internal Review Board (IRB) on 22 October 2024 (eBASE IRB Protocol #023/Oct2024/Exp). The study was commissioned by Effective Basic Services (eBASE) Africa with support from the Education Endowment Foundation (EEF UK), and the approval covered the period from October 2024 to May 2025. The IRB noted that the study involved minimal risk to human subjects, that data were collected in a non-invasive manner and that the intervention covered the South West Region of Cameroon. The IRB states that it operates in compliance with the World Medical Association Declaration of Helsinki.

Approved documents. The IRB approved the research protocol, the IRB application letter, the child assent form, the informed consent form for parents of minors, the parental permission form, the chronogram of activities, and the pre-workshop and post-workshop surveys. These documents provided for parental permission and child assent in respect of the learners who took the numeracy test.

Teacher participation. Teachers were informed about the project, the intended use of the data, voluntary participation and the right to withdraw at any time without penalty. Although the selected schools and classes were included in the project as a whole, each teacher's participation in data collection remained voluntary.

Access and permissions. Before engaging with the selected schools, access was obtained from regional pedagogic officials, ensuring alignment with educational policies and institutional frameworks. Institutional approval was sought from school authorities, and administrative and school permissions were obtained before data collection began. School administrators were briefed on the study's objectives, procedures and ethical safeguards.

Conduct and confidentiality. Data-collection personnel were sensitised before fieldwork, and trained enumerators conducted all interactions with teachers, learners and school authorities professionally, upholding respect, confidentiality and voluntary participation throughout the process. Learner numeracy results are reported only at school and class level, and audit results are reported as percentages across the ten teachers, so no individual learner or teacher is identified in this report.

Conditions of the approval. The approval required that the IRB be notified of any changes to approved documents at least four weeks before the modified documents were used, that participant complaints, worries or proposals for change be reported to the IRB, and that a study report be submitted to the IRB by 30 September 2025, or any extension be notified in writing

Data Presentation and Analysis

4.1 Demographic Data for Teachers Across Schools

The demographic data of teachers involved in the project provide insight into the composition of educators implementing the intervention, including school names, class levels, gender distribution and school category. The project was implemented across five primary schools: G.S. Ngeme, G.S. Wovia, G.S. Mokundange, G.S. Batoke and I.G.P.S. Botaland, each with teachers from Primary One and Primary Two actively involved. All ten participating teachers were female, which reflects the existing staffing pattern of early-grade classes in the participating schools rather than a selection criterion.

All five participating schools were categorised as intervention schools, meaning teachers teaching primary one and two in these schools were directly engaged in implementing metacognition and self-regulated learning strategies, with their practice systematically monitored and evaluated across the initial, midline and end-line audits.

4.2 Teacher Compliance with Best Practices

The 58-item checklist records whether specified practices or enabling conditions were observed. Because the checklist includes different types of indicators, the percentages should be interpreted item by item and, where appropriate, by clearly defined domains. They should not be treated as a single score of teacher competence or as a complete measure of implementation fidelity without further validation.

The figures below present teacher compliance at the initial audit and end line. The y-axis represents the percentage of teachers meeting each indicator (0 to 100%) and the x-axis represents the 58 individual audit items, numbered as in Appendix 1. While some indicators show full compliance, suggesting effective uptake of the associated practice, others show partial or limited adherence,

pointing to gaps in implementation. These variations may reflect contextual factors such as resource availability, teacher confidence, or classroom dynamics.

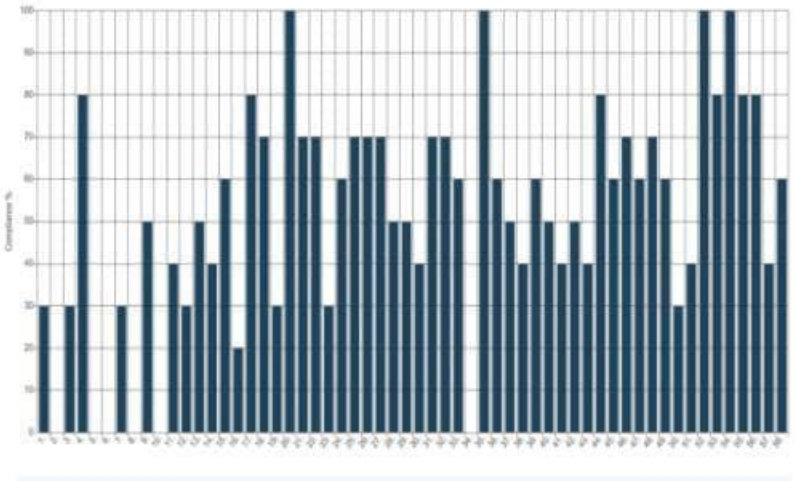

Figure 1: Teacher compliance with best practices at the initial audit

At the initial audit, conducted after training, item-level compliance ranged from 0% to 100%. Six items (2, 5, 6, 8, 10 and 34) recorded 0%, while four (20, 35, 52 and 54) recorded 100%. These results indicate uneven observation of practices and enabling conditions during early implementation, not teachers' practice before training.

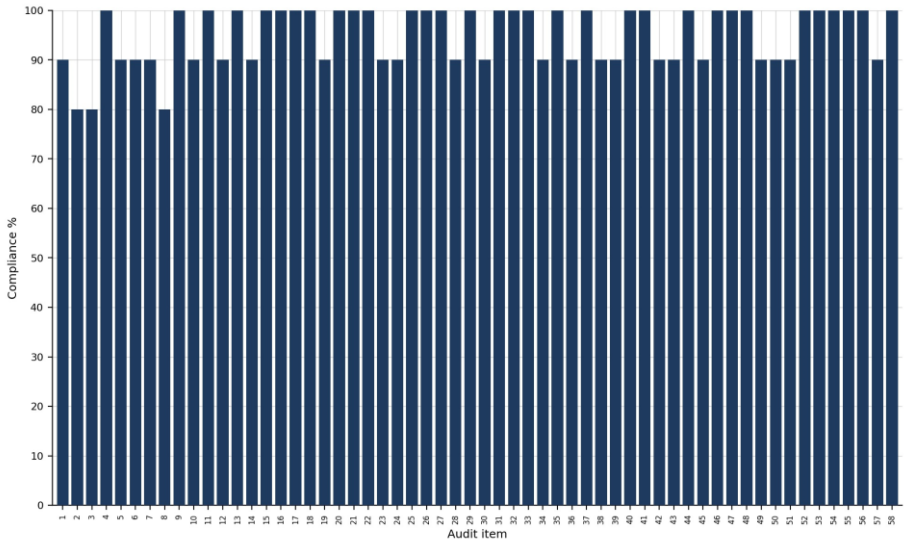

Figure 2: Teacher compliance with best practices at end line

At end line, compliance ranged from 80% to 100%. Thirty-two of the 58 indicators recorded 100%; three (items 2, 3 and 8) recorded 80% and the remaining 23 recorded 90%. Fifty-four indicators increased from the initial audit and four remained at 100%. This is a descriptive pattern of increased compliance, not proof of intervention impact.

Comparing the initial audit and end-line data, the reported figures indicate increased observation of many metacognition and self-regulated learning practices. This pattern is consistent with the training, follow-up support and feedback provided during the project. However, because training preceded the initial audit and there was no comparison group, the data cannot establish how much change occurred from teachers' pre-training practice or whether the intervention alone caused the observed differences.

Table 2 condenses the 58 indicators into eight editorially defined thematic groups. All item-level results are retained in Appendix 2, and item wording appears in Appendix 1. These groups organise reporting and are not validated subscales.

Table 2: Mean item compliance by thematic group, initial audit to end line

Thematic group	Items	No. of items	Initial (%)	Midline (%)	End line (%)	Change (pp)
Planning, reflection and regulation	1 to 4	4	35.0	67.5	87.5	+52.5
Explicit metacognitive instruction	5 to 14	10	24.0	65.0	92.0	+68.0
Modelling, scaffolding and guided practice	15 to 28	14	60.7	87.1	97.1	+36.4
Challenge, cognitive strategies and task support	29 to 37	9	55.6	82.2	96.7	+41.1
Classroom dialogue and peer interaction	38 to 44	7	51.4	80.0	94.3	+42.9
Independent practice and self-evaluation	45 to 51	7	55.7	81.4	94.3	+38.6
Professional learning and implementation support	52 to 57	6	80.0	95.0	98.3	+18.3
Observable indicators of self-regulation	58	1	60.0	80.0	100.0	+40.0

Each entry is the unweighted arithmetic mean of item compliance percentages within the listed group; each item is assigned once. Changes are calculated from unrounded means and shown in percentage points (pp). The initial audit followed training and is therefore not a pre-training baseline. The groups are descriptive reporting categories, not validated measures of teacher competence. Item 58 is shown separately because its wording concerns observable indicators used to assess self-regulation. Full results appear in Appendix 2.

The checklist data show increases from the initial audit to end line on many indicators. The magnitude and meaning of each change should be interpreted in light of the item definition, the initial score and whether the item describes classroom practice or an enabling condition. The results indicate observed changes in the participating classrooms; they do not, on their own, establish improved learner outcomes or causal impact.

High compliance was evident in several areas where teachers showed both strong uptake and consistent application of metacognitive strategies by end line. For example, item 5 ("Does the teacher create awareness in the learners of the metacognitive demands of the topics they are studying?") recorded 90% compliance at end line, up from 0% at the initial audit, suggesting teachers increasingly helped learners understand not just what they were learning but how they were learning it. Item 6 ("Does the teacher provide explicit instruction in metacognitive strategies such as planning,

monitoring and evaluating during learning tasks?") also rose from 0% to 90%, reflecting improved integration of metacognitive instruction into everyday teaching. Item 10 (introducing the general importance of planning, monitoring and evaluating before specific strategies) also reached 90% compliance, up from 0%.

Item 8 (supporting learners in self-assessing and evaluating the effectiveness of their plans and strategies) rose from 0% to 80% by end line, and item 2 (guiding learners to plan their approach to tasks using prior knowledge and known strategies) also rose from 0% to 80%, indicating that teachers increasingly recognised the value of activating learners' prior knowledge as a foundation for new learning.

Some indicators began with high compliance and remained at 100% across the reported stages. These values should be interpreted cautiously: they may indicate existing strengths, but the ceiling leaves no room to register further improvement. The wording of each item should be checked against Appendix 1 before assigning a substantive interpretation, particularly where the item concerns resources, mentoring or teacher preparedness rather than an observable classroom practice.

Moderate compliance growth was observed in indicators that were already relatively strong at the initial audit. Item 4 (explicit guidance on the metacognitive regulation cycle) rose from 80% to 100%, and item 17 (incorporating questions and reflection during modelling) showed similar growth from 80% to 100%. Items 53, 55 and 56, relating to continuing professional development, also moved from 80% to 100% compliance, underscoring the role of a supportive professional development environment in sustaining metacognitive teaching practice.

Overall, the checklist data show a positive descriptive trend in the proportion of indicators recorded as meeting their criteria. The largest increases occurred on some indicators with low or zero initial scores, while others remained high. Since the checklist combines classroom practices and enabling conditions, and the initial audit followed training, the results should not be interpreted as a definitive measure of change in overall teaching competence or as proof that the programme caused the changes.

4.3 Learner Numeracy Test Results Across Three Terms

This section presents primary data collected through direct administration of the same standardised learner numeracy assessment test during the first, second and third terms of the implementation year. The test was administered to learners in the participating Primary One and Primary Two classes. Results are presented by school and class across the three assessment rounds. They were recorded at school and class level only; learner-level scores are not available.

Table 3: Learner numeracy test success rate by school and term

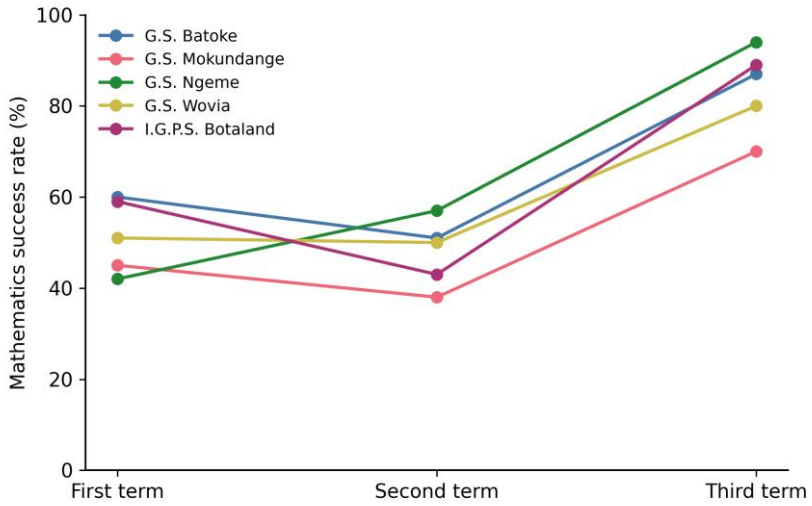

Figure 3: Learner numeracy test success rate by school and term

School	First term (%)	Second term (%)	Third term (%)	Change (pp)
G.S. Batoke	60	51	87	+27
G.S. Mokundange	45	38	70	+25
G.S. Ngeme	42	57	94	+52
G.S. Wovia	51	50	80	+29
I.G.P.S. Botaland	59	43	89	+30

The school-level numeracy test results show variation across schools and terms, with higher third-term than first-term success rates in all five schools. Because the same standardised test was administered in each term, differences in test form or routine school examination difficulty do not explain these comparisons. However, regular classroom instruction, learner maturation, attendance, learner composition and familiarity with repeated testing may also have contributed. The pattern does not establish that the intervention caused the changes.

At G.S. Batoke, learner performance was relatively strong in the first term, with a success rate of 60%. This dropped to 51% in the second term before rising sharply to 87% in the third term. G.S. Mokundange followed a similar pattern: a 45% success rate in the first term declined to 38% in the second term, before a marked rise to 70% in the third term.

At G.S. Ngeme, the data show a consistent upward trend across all three terms: from 42% in the first term, to 57% in the second term, reaching 94% in the third term. G.S. Wovia showed stable performance in the first two terms (51% and 50% respectively), with a more notable increase to 80%

in the third term. Finally, I.G.P.S. Botaland began at a 59% success rate in the first term, declined to 43% in the second term, and then rose to 89% in the third term.

Table 4: Learner numeracy test success rate by class and term

Class	First term (%)	Second term (%)	Third term (%)	Change (pp)
Primary One	51.0	46.3	84.7	+33.7
Primary Two	54.7	50.1	83.0	+28.3

Results were recorded at school level (Table 3) and at class level (Table 4) only, without learner-level scores or tested counts, so the two tables cannot be combined into a single overall learner percentage. Table 5 therefore compares them using only the reported figures: the simple mean of the five school rates, the mean of the school rates weighted by enrolment (Table 1), and the mean of the two class rates weighted by enrolment (Table 1).

Table 5: Summaries of Table 3 and Table 4 by term

Summary	First term (%)	Second term (%)	Third term (%)	Change (pp)
School rates, simple mean	51.4	47.8	84.0	+32.6
School rates, weighted by enrolment	51.1	44.8	81.2	+30.1
Class rates, weighted by enrolment	52.9	48.2	83.8	+31.0

The three summaries differ in level by up to 3.4 percentage points, with the largest gap in the second term, because the school and class rates carry no tested counts and different weighting gives different overall values. They agree on direction, a fall in the second term followed by a rise in the third term, and on the size of the first-to-third-term difference, which lies between 30.1 and 32.6 percentage points. This report therefore relies on the school-level and class-level rates as reported, and on the direction and approximate size of change, and does not report a single overall learner percentage.

4.4 Feedback Sessions

After each phase of data collection (initial audit, midline and end line), structured feedback sessions were organised, bringing together pedagogic inspectors, headteachers, teachers and other relevant stakeholders. These sessions provided a platform to reflect on findings from each stage, discuss gaps identified during classroom observation, and explore the challenges teachers faced in implementing the metacognition and self-regulated learning approach, as well as to propose mitigation measures.

4.4.1 Opening of the Feedback Sessions

Each feedback session opened with an overview of findings from the relevant data collection phase. At the initial audit, it was noted that while some teachers had begun using metacognitive and self-regulated learning strategies, overall implementation was inconsistent. By midline and end line, there were clear signs of improvement, particularly in how teachers integrated metacognitive strategies into their teaching, although gaps remained and were discussed openly.

Participants discussed think-aloud modelling and learners' willingness to explain their reasoning. Some teachers reported that learners remained hesitant to articulate their thinking. Quantified examples are linked to specific checklist items and audit rounds in Section 4.4.4 and Appendix 2.

4.4.2 Discussions on Implementation and Challenges

Teachers shared their experiences implementing metacognitive and self-regulated learning strategies, reflecting on methods such as goal setting, self-reflection and thinking-aloud, and how they adjusted practice to meet learners' diverse needs. Teachers also highlighted several challenges:

Time constraints: teachers noted that it was often difficult to find sufficient time to engage learners in reflective activities and incorporate metacognitive strategies within the demands of the existing curriculum.

Learner engagement: while many teachers reported improvements in learners' ability to set goals and reflect on their learning, some learners, including some with learning disabilities, needed more time and additional support to engage confidently with these practices, particularly where they found it difficult to articulate their thinking aloud.

Large class sizes: many teachers found it difficult to give individual attention to learners, particularly those who needed more support with self-regulation and metacognition, given the high teacher-to-pupil ratio in their classrooms.

4.4.3 Identified Gaps and Mitigation Measures

Based on observation and feedback, several gaps were identified:

Inconsistent implementation: although many teachers had begun using strategies such as thinking-aloud and goal setting, implementation was not consistent across all classrooms, and not all learners were fully benefiting from these practices.

Need for differentiation: teachers recognised that metacognitive and self-regulated learning strategies had not always been tailored to meet the needs of learners with disabilities or those who needed more support with self-regulation.

Limited resources: at the initial audit, some teachers reported not having enough resources to effectively support learners' engagement with metacognitive strategies. In response, the following mitigation measures were proposed and adopted:

Providing structured time for metacognitive activities: teachers were encouraged to set aside specific periods within lessons for goal setting and self-reflection, so these practices became a routine part of the classroom.

Peer-assisted learning: more advanced learners were encouraged to support peers with metacognitive practices, helping learners who needed extra guidance but were not otherwise receiving enough individual attention in large classes.

Differentiated instructional approaches: teachers were advised to tailor metacognitive strategies to better support diverse learners, including simplified reflection templates, additional scaffolding, and more hands-on activities.

To address the challenge of insufficient materials, eBASE Africa provided charts and a teacher's guide as support material during the midline feedback session, to improve implementation by end line.

4.4.4 Observed and Reported Changes Across Audit Rounds

Audit findings and feedback suggest increased use of several metacognitive and self-regulated learning practices during implementation. The item-level audit data provide clearer examples. Guidance on learning goals and approaches (item 7) increased from 30% to 90%; guidance on specific short-term goals (item 50) increased from 30% to 90%. Awareness of metacognitive task demands (item 5) and explicit instruction in planning, monitoring and evaluating (item 6) each increased from 0% to 90%. These are distinct indicators, not a combined measure.

Four indicators remained at 100%: habitual cognitive and metacognitive practice (item 20), rehearsal of complex-task components (item 35), time for training and embedding strategies (item 52), and tools, resources and mentoring (item 54). The first two concern classroom practice and the latter two enabling conditions.

These quantitative results were supported by qualitative feedback from teachers.

> *Since implementing metacognitive strategies, I've seen a significant improvement in how my learners approach their work. They now set clear goals and reflect on their learning regularly. This has helped my students, including those with learning disabilities, become more engaged in Mathematics.*
>
> *Teacher, end-line feedback session*

Teachers across multiple schools echoed similar observations, noting that learners appeared more independent and had begun articulating their learning strategies without being prompted.

In summary, the end-line audit reports increased use of many metacognitive and self-regulated learning practices over the project period. Some practices showed larger changes than others, while a number of indicators were already at ceiling. Because the first audit followed training and there was no comparison group, these results describe observed change during implementation and do not establish a causal effect.

Discussion and Findings

5.1 Feasibility and Acceptability of the Project

Stakeholder feedback suggests that teachers increasingly viewed metacognition and self-regulated learning strategies as useful and more manageable as they gained experience with them. Teachers described reflection prompts, goal-setting frameworks, practical lesson guides and peer or

headteacher support as helpful. These accounts provide evidence of perceived acceptability among participants who contributed feedback, but the report does not present a standardised acceptability measure or a quantified project-wide estimate.

5.2 Influence on Implementation

Several teachers reported using metacognitive and self-regulated learning strategies with increasing confidence over the project period. Think-alouds, self-assessment checklists and learner reflection routines were described as becoming part of classroom activities. Some teachers who participated in ongoing professional learning opportunities, including the Maths Hub, reported more consistent use. These are reported experiences and associations; the available design does not establish that any single support component caused the changes.

5.3 Perceived Usefulness of Teacher Training

Teacher reflections indicated that the training sessions deepened their understanding of metacognition and self-regulated learning. Many found the examples and classroom-based applications helpful for translating theory into practice, and teachers with little prior exposure to these concepts felt the training opened new perspectives on how learners can become more independent and reflective. Some teachers noted that they would have valued more time and follow-up sessions to fully internalise and integrate the strategies. Overall, the training was seen as an important starting point, with practical demonstration and peer learning adding to its effectiveness.

5.4 Changes in Teachers' Attitudes and Behaviours

There was a clear shift in teachers' own accounts of their attitudes toward metacognition and self-regulated learning over the course of the project. Strategies that were initially met with some hesitation were, by end line, more often described as important for helping learners become more autonomous and thoughtful. Teachers reported increased confidence in the potential of learners, even at early grade levels, to reflect on their thinking and manage aspects of their own learning. Behaviourally, teachers described asking more open-ended questions, allowing more time for reflection, and encouraging learners to explain how they arrived at their answers.

5.5 Learners' Academic Performance, Engagement and Autonomy

Classroom observations and teacher reports described increased learner engagement, confidence and problem-solving behaviour over the project period. These observations and accounts suggest possible positive changes, but the report does not present a separate, systematic learner-level measure sufficient to quantify changes in autonomy or self-regulation. Such outcomes should therefore be described as observed or teacher-reported rather than as established changes for all learners.

The reported learner numeracy test percentages are higher in the third term than the first term at each school and in both classes. The summaries in Table 5 give a first-to-third-term difference of between 30.1 and 32.6 percentage points. These are primary results from direct administration of the same standardised test in three assessment rounds. Regular teaching, maturation, attendance, learner composition and test familiarity may contribute to the pattern, and no comparison group was included. The trend is descriptive and cannot be attributed to the intervention alone.

5.6 Integration of the Approach and Observed Changes

Findings indicate that integration of metacognitive and self-regulated learning strategies became more widespread as the project progressed, with teachers moving from occasional experimentation toward embedding these approaches into their lesson structure. Reflection activities, planning templates and learner goal-setting routines were used increasingly often. In classrooms where teachers observed improved learner engagement, the strategies tended to be adopted more fully, and some teachers began adapting existing lesson plans to include metacognitive elements, suggesting the approach was becoming part of everyday teaching rather than a stand-alone add-on.

The checklist results suggest that the proportion of indicators meeting their stated criteria increased over time. Because indicators include both classroom practices and enabling conditions, and because the initial audit followed training, these results should not be summarised as a definitive measure of consistent implementation across classrooms without further qualification. Item-level results and definitions are provided in Table 2 and Appendices 1 and 2.

5.7 Implications of the Findings

The findings suggest that practical tools, examples and peer support may help teachers use metacognitive and self-regulated learning strategies. However, the small purposive sample, post-training initial audit, absence of a comparison group, and the availability of learner results at school and class level only limit the strength of conclusions.

5.8 Limitations of the Study

The study has several limitations. First, the study involved five purposively selected schools and ten teachers, limiting transferability. Second, there was no comparison group, so observed changes cannot be attributed to the intervention alone. Third, learner numeracy results were recorded at school and class level only, without learner-level scores or tested counts, so school-level and class-level rates could be compared only through the summaries in Table 5 and learner-level change could not be analysed. Finally, learner engagement and autonomy are supported mainly by observation and teacher reports rather than a separately reported, systematic learner-level measure. These limitations should inform interpretation and future evaluation.

5.9 Recommendations

In light of these findings, several steps are recommended to strengthen the sustainability and impact of the intervention. Continuous professional development should be prioritised: while the initial training provided a strong foundation, sustained progress is likely to require regular follow-up sessions, mentorship, and opportunities for peer learning and collaborative reflection, which would help reinforce teachers' understanding and confidence in applying these strategies.

Integrating metacognition and self-regulated learning into both pre-service and in-service teacher training curricula would help ensure that teachers, whether new to the profession or experienced, are systematically equipped with the skills needed to support learners in becoming more autonomous and reflective thinkers.

Contextualised, easy-to-use teaching resources should continue to be provided, since teachers are more likely to implement metacognitive strategies consistently when they have access to clear lesson plans, classroom tools and practical guides aligned with the local curriculum and classroom conditions.

A supportive school culture that values reflective teaching should be promoted, with school leaders and administrators actively engaged in providing the enabling environment teachers need, including time for planning, opportunities for collaboration, and recognition of teachers' efforts.

Finally, a structured system for monitoring and evaluating the ongoing implementation of metacognition and self-regulated learning strategies is recommended, ideally including a comparison group and independent outcome assessment in any future evaluation, to allow more confident conclusions about the intervention's effect. Regular feedback loops involving both teachers and learners would support timely adjustments and help document practices that could inform future scale-up. Future rounds should capture and retain learner-level scores in a secure, anonymised dataset; define the success rate and the scoring rule behind it; record tested counts and missing assessments; and track learners with anonymised identifiers.

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Appendix 1: Audit Criteria Checklist

Metacognition and self-regulated learning observation checklist (58 items).

No.	Audit item
1	Does the teacher guide learners on how to reflect on their own strengths and weaknesses as part of their learning process?
2	Are learners guided to plan their approach to tasks by considering their prior knowledge and the strategies they know?
3	Does the teacher support learners in evaluating their overall success after completing a task, and in considering alternative strategies if they encounter difficulties?
4	Are novice learners given explicit guidance on the metacognitive regulation cycle (plan, monitor, evaluate) to help them become more effective self-regulated learners?
5	Does the teacher create awareness in the learners of the metacognitive demands of the topics they are studying?
6	Does the teacher provide explicit instruction in metacognitive strategies such as planning, monitoring, and evaluating during learning tasks?
7	Does the teacher guide learners to set clear learning goals and plan appropriate approaches to achieve them?
8	Does the teacher support learners in self-assessing and evaluating the effectiveness of their plans and strategies after completing a task?
9	Does the teacher use interactive questioning and feedback to develop learners' metacognitive reflection during lessons?
10	Does the teacher introduce the general importance of planning, monitoring, and evaluating before diving into specific metacognitive strategies?
11	Does the teacher activate learners' prior knowledge to prepare them for learning new metacognitive strategies?
12	Are subject-specific metacognitive strategies explicitly taught through the content of the lesson?
13	Does the teacher facilitate guided practice, ensuring that learners can contribute ideas and apply the strategy with support?

14	Are learners provided with opportunities for independent practice to apply the learned strategy on their own?
15	Does the teacher ensure that learners have access to the relevant knowledge before modelling a task or skill?
16	Are learners engaged in the task being modelled, and do they have opportunities to practice it immediately after the demonstration?
17	Does the teacher incorporate questions and reflections during modelling to reinforce key steps and strategies for learners?
18	Does the teacher create opportunities for learners to think independently and monitor their own learning?
19	Does the teacher balance scaffolding with opportunities for learners to think independently and monitor their own learning?
20	Are learners encouraged to develop habitual cognitive and metacognitive thinking through repeated practice and independent work?
21	Does the teacher support the transition from guided practice to independent learning, helping learners build internal scaffolding for future tasks?
22	Does the teacher use worked examples to model step-by-step solutions to problems before gradually removing the scaffolding?
23	Does the teacher ensure that learners understand each step in the process before moving on to more independent practice?
24	Are students given opportunities to reflect on their metacognitive strategies after completing a task, rather than during it, to avoid cognitive overload?
25	Does the teacher assess whether learners are ready to move from a fully scaffolded task to a partially completed or independent one?
26	Does the teacher provide clear and accessible examples that illustrate the steps involved in solving a particular problem or task?
27	Does the teacher use adequate worked examples to support and scaffold the learners?
28	Does the teacher monitor and intervene when the learners are solving a problem?
29	Does the teacher ensure that tasks are sufficiently challenging to promote the development of self-regulation and metacognition in learners?

30	Does the teacher encourage learners to engage in metacognitive reflection, especially when they are faced with challenging tasks?
31	Does the teacher support learners in identifying the most difficult aspects of a task and strategies to tackle them effectively?
32	Does the teacher help learners understand and assess their own knowledge and motivation when approaching challenging tasks?
33	Are learners guided to use metacognitive strategies such as effective note-taking, asking for help, and devising plans to stay focused when they encounter difficulties?
34	Does the teacher set challenges at an appropriate level to avoid overwhelming students while still promoting growth in their learning?
35	Are learners taught to rehearse components of complex tasks to automate processes and free up working memory capacity?
36	Does the teacher encourage learners to create stories or group information into chunks to enhance memory and reduce cognitive load?
37	Does the teacher break down complex tasks into simpler steps to facilitate learners' understanding and self-regulation?
38	Does the teacher apply cognitive strategies to improve the quality of classroom dialogue?
39	Are peers involved in developing each other's metacognitive strategies through classroom interactions?
40	Does the teacher encourage learners to reflect on past challenges to enhance metacognitive awareness?
41	Does the teacher use dialogic teaching to promote effective classroom dialogue for metacognitive development?
42	Does the teacher implement Socratic talk and similar strategies to organise classroom dialogue and enhance metacognitive skills?
43	Is classroom dialogue structured to be purposeful rather than merely conversational for fostering metacognitive skills?
44	Are discussion and dialogue emphasised as key forms of classroom talk for developing metacognitive skills?
45	Are metacognitive strategies integrated into the support provided during independent practice to enhance learners' self-regulation?

46	Does the teacher model effective revision approaches, such as using self-testing flashcards, to support independent learning?
47	Is guided practice used by the teacher to provide support and scaffolding during the initial stages of learning?
48	Does the teacher gradually transfer more responsibility to learners as they become more proficient in their independent learning?
49	Are tasks designed to be sufficiently challenging, build on existing subject knowledge, and be realistic for promoting independent practice?
50	Does the teacher guide learners in setting specific short-term goals to aid their independent learning?
51	Does the teacher teach learners how to self-evaluate their methods and adjust their approach as needed?
52	Are teachers provided with sufficient time to train, practice, and embed new metacognitive and self-regulation strategies into their classroom practice?
53	Do teachers receive high-quality professional development to enable them to integrate metacognition and self-regulation into specific subject domains or phases?
54	Are teachers equipped with high-quality tools and resources, including textbooks and ongoing mentoring, to support the implementation of metacognitive strategies?
55	Is sufficient time and resources devoted to continuing professional development (CPD), with activities designed to be iterative and responsive to classroom needs?
56	Does the CPD build on teachers' existing knowledge and challenge their existing beliefs and practices where necessary to improve their understanding?
57	Are the tools and resources provided to teachers designed to help them effectively integrate metacognitive strategies into their regular classroom activities?
58	Are observable metacognitive strategies, such as underlining a passage or making notes, used by teachers to assess self-regulation?

Appendix 2: Full Item-Level Teacher Audit Results

All 58 reported audit indicators are reproduced without altering their numerical values. Initial audit occurred after training. Item wording is provided in Appendix 1. Changes are end line minus initial audit, in percentage points.

Item	Initial audit (%)	**Midline (%)**	**End line (%)**	**Change (pp)**
1	30	60	90	+60
2	0	40	80	+80
3	30	70	80	+50
4	80	100	100	+20
5	0	50	90	+90
6	0	60	90	+90
7	30	60	90	+60
8	0	50	80	+80
9	50	80	100	+50
10	0	60	90	+90
11	40	70	100	+60
12	30	70	90	+60
13	50	80	100	+50
14	40	70	90	+50
15	60	90	100	+40
16	20	90	100	+80
17	80	90	100	+20
18	70	90	100	+30
19	30	70	90	+60

20	100	100	100	+0
21	70	90	100	+30
22	70	90	100	+30
23	30	70	90	+60
24	60	80	90	+30
25	70	90	100	+30
26	70	90	100	+30
27	70	100	100	+30
28	50	80	90	+40
29	50	80	100	+50
30	40	70	90	+50
31	70	100	100	+30
32	70	90	100	+30
33	60	80	100	+40
34	0	60	90	+90
35	100	100	100	+0
36	60	80	90	+30
37	50	80	100	+50
38	40	70	90	+50
39	60	80	90	+30
40	50	80	100	+50
41	40	80	100	+60

42	50	80	90	+40
43	40	70	90	+50
44	80	100	100	+20
45	60	80	90	+30
46	70	90	100	+30
47	60	90	100	+40
48	70	90	100	+30
49	60	80	90	+30
50	30	70	90	+60
51	40	70	90	+50
52	100	100	100	+0
53	80	100	100	+20
54	100	100	100	+0
55	80	100	100	+20
56	80	100	100	+20
57	40	70	90	+50
58	60	80	100	+40