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Strengthening Teacher
Education for Foundational
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Executive Summary

This report presents findings from the Policy and Curriculum Environment Analysis conducted under Component 4 of the National Numeracy Initiative in Kenya. The study reviewed policies, curriculum frameworks, teacher training programmes, instructional practices, and resources supporting foundational numeracy in early grades within the Competency-Based Curriculum. Evidence was drawn from policy reviews, textbook analyses, stakeholder interviews, focus group discussions, and lesson observations in three Teacher Training Colleges (TTCs).

The analysis reveals notable strengths. Kenya has adopted globally aligned teacher education frameworks and policies, with reforms on teacher education underway. Teacher educators demonstrate strong content mastery and increasingly employ trainee-centred, inquiry-based, and collaborative pedagogies. Lesson observations confirmed greater use of manipulatives and activity-based approaches. Mathematics textbooks for pre-primary and lower primary are well aligned with international guidelines, emphasising scope, sequencing, and problem-solving skills. Stakeholders identified continuous professional development, mentorship, and cross-agency collaboration as critical levers for sustaining progress.

Despite these advances, key weaknesses persist. Gaps in policy awareness and implementation undermine impact, while misalignment between language-of-instruction policies and teacher deployment hinders effective early grade learning. While the CBE reforms have had key gains, there are persistent gaps in the integration of learner-centred approaches, teacher capacity for formative assessment and transformative learning approaches. Inclusivity and social-emotional learning (SEL) integration remain inconsistent, and SEL competencies are only sporadically embedded in textbooks. Large class sizes, inadequate teaching aids, and limited ICT resources further constrain instructional quality.

Kenya's teacher-education system for foundational numeracy is at a turning point: national frameworks align with global standards, yet awareness and implementation remain uneven. Across TTCs, tutors show strong PCK, but lesson-orchestration weaknesses (inconsistent use of manipulatives, inclusive routines, and formative feedback) blunt impact. SEL/VbE integration is inconsistent. This report therefore recommends: (1) the finalisation and dissemination of teacher education and foundational learning policies and aligning teacher deployment with language-of-instruction; (2) continuous teacher retooling on transformative pedagogies in teacher education; (3) relief of class sizes and tracking Diversity Equity and Inclusion (DEI); (4) development of a structured teachers' mathematics guide to complement PP1–Grade 3 learners' textbooks; and (5) adoption of culturally relevant contexts, and practical assessment. These steps translate policy into reliable classroom practice and accelerate equitable FLN gains.

Acknowledgement

This report was authored by **Dr. Reuben Mutegi**, whose technical expertise, analytical rigor, and deep understanding of the subject matter were instrumental in the development of the study and the preparation of this document. His leadership in synthesizing the evidence, structuring the analysis, and articulating the findings formed the foundation upon which this report is built.

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Their contributions included reviewing the conceptual framing, refining the presentation of evidence, strengthening the interpretation of findings, and ensuring that the document met the expected standards of a high-quality technical report. The collaborative engagement of these reviewers helped improve the overall quality of the report and contributed to the production of the final, polished version presented here.

While many individuals contributed to the refinement of this work, any remaining errors or omissions remain the responsibility of the author. The collective efforts of all those acknowledged here reflect a shared commitment to advancing evidence-informed practice and strengthening the quality of technical knowledge products.



Abbreviations and Acronyms

ADEA	: Association for the Development of Education in Africa
ATQF	: African Teacher Qualification Framework
BECF	: Basic Education Curriculum Framework
CASEL	: Collaborative for Academic, Social, and Emotional Learning
CBAF	: Competency-Based Assessment Framework
CBC	: Competency-Based Curriculum
CBE	: Competency-Based Education
CBTE	: Competency-Based Teacher Education
CEMASTEA	: Centre for Mathematics, Science and Technology Education in Africa
CESA	: Continental Education Strategy for Africa
CPA	: Concrete–Pictorial–Abstract
CPD	: Continuous Professional Development
CSOs	: Curriculum Support Officers
DECTE	: Diploma in Early Childhood Teacher Education
DEI	: Diversity, Equity and Inclusion
DFID	: Department for International Development
DPTE	: Diploma in Primary Teacher Education
ECDE	: Early Childhood Development and Education
EYE	: Early Years Education
FLN	: Foundational Literacy and Numeracy
GPE	: Global Education Partnership
GPF	: Global Proficiency Framework
GPFM	: Global Proficiency Framework for Mathematics
IDRC	: International Development Research Centre
ISCED-T	: International Standard Classification of Teacher Training Programmes
KeSTEM	: Kenya School of Teacher and Education Management
KICD	: Kenya Institute of Curriculum Development
KIQ	: Key Inquiry Question
KNEC	: Kenya National Examinations Council
MoE	: Ministry of Education
MTP	: Medium Term Plan
NESSP	: National Education Sector Strategic Plan
NWG	: National Working Group
OECD	: Organisation for Economic Co-operation and Development
OER	: Open Educational Resources
PCK	: Pedagogical Content Knowledge
PE&E	: Parental Empowerment and Engagement
QASO	: Quality Assurance and Standards Officer
RC	: Recall
SAGAs	: Semi-Autonomous Government Organisations
SBTS	: School-Based Teacher Support
SCDE	: Sub-County Director of Education
SCEO	: Sub-County Education Officer
SEL	: Social-Emotional Learning
SQASO	: Sub-County Quality Assurance and Standards Officer
TECF	: Teacher Education Curriculum Framework
TPD	: Teacher Professional Development
TSC	: Teachers Service Commission
TTCs	: Teacher Training Colleges
VbE	: Value-based Education

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1 Introduction



This report presents findings from the Policy and Curriculum Environment Analysis conducted under Component 4 of the National Numeracy Initiative in Kenya. The study examined how curriculum frameworks, teacher education programmes, educational policies, instructional practices, and resources support the development of foundational numeracy in early grades (PP1–Grade 3).

Foundational numeracy is a strong predictor of later academic achievement in mathematics and science (Siegler, 2017). Evidence from low- and middle-income countries highlights effective pedagogy, enabling policies and standards, high-quality textbooks, and well-prepared teachers and school leaders as key drivers of improved learning outcomes (Crouch & DeStefano, 2017; Evans et al., 2019).

Since 2021, Kenya's teacher education system has undergone significant reforms to align with Competency-Based Education (CBE). The Competency-Based Teacher Education (CBTE) curriculum emphasises Pedagogical Content Knowledge (PCK), supported by extended microteaching, mentorship, and practical teaching experience. Implementation has been facilitated through teacher education handbooks, draft frameworks, and improved ICT infrastructure, including e-learning and e-assessment tools. Following recommendations of the Presidential Working Party Report (2023), teacher training programmes were restructured, with investments in digital infrastructure, retooling for CBE, and integration of Social Emotional Learning (SEL). These reforms have promoted learner-centred, inquiry- and play-based approaches, and the use of manipulatives in numeracy instruction.

The analysis is based on a thorough examination of several key national documents on education, focusing on numeracy, curriculum, and teacher education. These policies and guidelines were analysed to determine systemic strengths and gaps, assess their conformity to international foundational numeracy standards, and provide useful suggestions for improved outcomes. Insights from the analysis will inform policy reviews and implementation frameworks for improved numeracy outcomes.

The report also provides evidence-based analyses and recommendations derived from structured interviews with education policymakers and principals of TTCs and from lesson observations conducted in three TTCs from 8th to 17th July 2025. The aim was to assess the preparedness of teacher trainees to deliver foundational numeracy within Kenya's Competency-Based Education (CBE). Data were collected through: (a) systematic lesson observations, covering three numeracy lessons per college across various academic years and strands; (b) stakeholder interviews involving policy and curriculum leaders addressing foundational numeracy policies and alignment with regional and international standards; and (c) teacher educator interviews exploring instructional methods, assessment integration, parental engagement, resource requirements, SEL practices, and suggested improvements in national policies. The insights presented are designed to inform strategic actions to enhance foundational numeracy education in Kenya.

2 Literature Review



2.1. Alignment of Policies, Teacher Education Curricula and Programmes with Global and Regional Standards on Foundational Numeracy

2.1.1. National Policies

Reviewing global and regional policy frameworks to address existing gaps is a central element of Kenya's policy development process (GoK, 2024). In this context, Kenya has introduced progressive national frameworks such as the Basic Education Curriculum Framework (BECF, 2019), the Competency-Based Assessment Framework for Early Years (CBAF, 2021), and the National Education Sector Strategic Plan (NESSP 2023–2027). Together, these guide the implementation of Competency-Based Education (CBE) by defining curriculum scope and sequencing, promoting effective pedagogy, strengthening formative and summative assessment, supporting teacher education (pre-service and in-service), and enhancing stakeholder coordination for improved learning outcomes. At the international level, the Education 2030 Agenda Framework (targets and indicators), the OECD Learning Compass 2030 (competencies for future success), and the Global Proficiency Framework (GPF, 2019) proficiency levels for Grades 1–9 provide benchmarks for aligning Kenya's education priorities with global standards.

2.1.2. Teaching Standards

Kenya's teaching standards, as outlined in the Teacher Professional Development (TPD) Framework (TSC, 2018), are informed by the International Standard Classification of Teacher Training Programmes (ISCED-T, 2021), the UNESCO Global Framework of Professional Teaching Standards (2019), and the Africa Teacher Qualification Framework (ATQF, 2019). These international frameworks define teacher competencies and professional expectations aimed at advancing equitable, high-quality, and inclusive education. While Kenya's national policies reflect these global standards in principle, their impact is constrained by persistent gaps in alignment with continental benchmarks such as CESA 26–35 and in institutional ownership and implementation (World Bank, 2021). Key misalignments are observed in teacher standards and language of instruction in the early years of education.

2.1.3. Classroom Practice

Global standards for foundational numeracy emphasise the practical application of mathematical concepts in real-world contexts rather than memorisation (UNESCO, 2019). In addition, the standards call for problem-solving as a central component, ensuring that learners use mathematics to address authentic challenges and emphasise equity and inclusivity for support to learners at risk of underachievement (UNICEF, 2020; GPE, 2020). Systematic use of formative and summative assessments is expected to guide instruction, while integration of social-emotional learning enables

positive attitudes towards mathematics (CASEL, 2020). Kenya's shift towards CBC fosters alignment with these global standards. However, reports from UNICEF (2020) and RISE (2021) indicate that despite these policy commitments, many children in developing country contexts, including Kenya, fail to achieve mastery of basic numeracy by the end of Grade 3. Furthermore, while policies reference real-world application of mathematics, classroom practice often defaults to abstract problems that do not reflect authentic contexts, limiting meaningful numeracy acquisition (World Bank, 2021).

Research increasingly shows that although Kenya's policy landscape is strongly aligned with global and regional frameworks such as SDG4 benchmarks, the Global Proficiency Framework (GPF), and the OECD Learning Compass, this alignment has not translated consistently into teacher education practice (UNESCO, 2023; World Bank, 2021). Recent studies highlight that TTCs continue to grapple with outdated course content and insufficient integration of CBC-aligned numeracy competencies, despite national reforms (Sitabkhan et al., 2024; Nyaga & Mbera, 2022). Core competencies emphasised in global guidance, such as problem-solving, conceptual numeracy, continuous assessment, inclusivity, and mother-tongue-supported instruction, are articulated within national frameworks such as the CBC and TPD Framework (TSC, 2021). However, TTCs often lack adequate preparation resources, structured practicum models, and evidence-based pedagogies such as Concrete-Pictorial-Abstract (CPA) and structured problem-solving (UNICEF, 2020; UNESCO IICBA, 2022). As a result, a persistent disconnect emerges between policy aspirations and teachers' practical readiness to deliver high-quality foundational numeracy in real classroom settings.

2.2. Teaching and Learning Materials

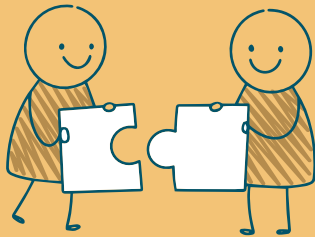
High-quality literacy and numeracy resources are essential for effective teaching and learning. In numeracy, well-designed textbooks and materials not only support classroom practice but also build children's conceptual understanding of number and operations. International guidance emphasises that resources should go beyond listing procedures to present a coherent scope and sequence, embed teacher support, and follow the Concrete-Pictorial-Abstract (CPA) progression, which helps learners move from tangible experiences to abstract reasoning (White Rose Education, 2025). Effective numeracy textbooks typically include:

- i) **Clear learning progressions** within domains such as number, operations, measurement, and geometry, with sequenced tasks that deepen conceptual understanding..
- ii) **Balanced task design**, combining scaffolded skill practice with open problem-solving activities that encourage reasoning, discussion, and flexible strategies..
- iii) **Purposeful use of manipulatives and representations**, with teacher guidance on linking concrete, pictorial, and symbolic forms (KICD, 2017).
- iv) **Integration with teacher professional support**, including guides, scripted lessons, formative assessments, and differentiation strategies, ensuring implementation fidelity (GPE, 2022).

Beyond content, textbooks also play a role in fostering social-emotional learning (SEL) by embedding group work, structured discussion, and reflection protocols that build collaboration, persistence, and mathematical dialogue (CASEL Framework). Finally, equity and language considerations are critical. Materials in children's mother tongues and grounded in culturally relevant contexts improve comprehension and help bridge informal and formal numeracy learning. Policy guidance recommends localised examples, gradual language transition, and tasks that draw on home-based numeracy practices to strengthen inclusivity.

Strengthening alignment between policy reforms, TTC curriculum, and classroom practice is therefore critical for improving foundational numeracy outcomes. International reviews emphasise that effective early numeracy instruction requires teachers to integrate conceptual understanding, formative assessment, social-emotional learning, and culturally relevant, real-world mathematical applications (UNESCO, 2022; GPE, 2021). Literature further shows that teacher trainees succeed when TTC programmes intentionally model CBC-aligned pedagogy and provide practicum opportunities grounded in authentic classroom realities (Murungi & Kimathi, 2023). When alignment is weak, teachers enter classrooms with strong theoretical knowledge but without the pedagogical agility needed to support diverse Grade 1–3 learners, particularly in numeracy domains where language

scaffolding, manipulatives, and learner-centred inquiry are essential (RISE, 2021). Embedding global and regional standards within TTC programmes, strengthening practicum supervision, and ensuring coherent curriculum and assessment design would therefore support more equitable, context-responsive, and impactful numeracy instruction across Kenyan classrooms.



2.3. Collaboration and Coordination for Improved Numeracy Outcomes

National frameworks emphasise concerted effort to promote learner-centred pedagogy, competency-based assessment, and continuous professional development as a central pillar for reforms in Kenya (MoE, 2021, 2023). Policy framework for teacher professional development underscores the need for multistakeholder engagement for improved learning outcomes (UIS, 2022; ATQF, 2019). However, limiting factors constrain the effective implementation of these progressive policies. Coordination of in-service training of teachers remains fragmented, with overlapping mandates between the Ministry of Education, Kenya Institute of Curriculum Development (KICD), Teachers Service Commission (TSC), and CEMASTEIA, leading to duplication and weakened accountability (World Bank, 2021). Parental engagement is emphasised in national policies but remains underutilised in practice due to weak operational mechanisms (UNICEF, 2020). Coordination of pre-primary education by county governments, while policy development rests with the Ministry of Education, calls for strong engagement to ensure alignment. These gaps reflect a broader global trend where alignment on paper does not guarantee effective implementation for improved practice (Piper et al., 2018). Strengthening evidence-based practice will require greater involvement of universities and research institutions, particularly in generating and disseminating insights through ongoing evaluation and observation studies (Darling-Hammond et al., 2017). Collaboration mechanisms such as joint policy review, shared capacity-building, and professional learning communities would ensure coherence, while a centralised digital feedback system could improve data use and accountability.

3 Methodology



The methodological framework involved extracting key information on policies and structures through document analysis and policy reviews. A systematic review of secondary data sources laid a particular emphasis on currency, quality, and relevance to numeracy in early grade learning. The overall study design was modelled to address the objectives effectively and the inherent theory of change. To collect primary data, an interview guide was prepared for key informants and Focus Group Discussions (FGDs). A purposive sampling approach was used to select the colleges and the stakeholders to interview. The detailed breakdown of the methodology is as follows.

3.1. Document Analysis and Policy Reviews

Policy documents with provisions on curriculum, teacher education, and early grade learning focused on national trends and institutional practices were reviewed to identify provisions on numeracy and assess alignment with global standards.

3.2. Study Design

The fourth component of the study was designed to be anchored on a qualitative approach to assess the readiness of Kenya's teacher education (pre-and in-service training) and policy environment to support foundational numeracy initiatives. This allowed for deep analysis of written policies, curriculum documents, and classroom practices.

3.3. Sampling Design

To identify respondents for the interviews with tutors and college principals, three (3) TTCs were sampled from the existing 35 public TTCs, such that one was a high-performing TTC, one was a medium-performing TTC, and the third was a low-performing TTC, distributed as follows:

Table 1: Distribution of Interview Respondents

Name of TTC	County / Region	Size Category	Estimated Enrolment	Performance
Machakos TTC	Machakos County, Eastern Kenya	Large TTC	1,800–2,000 students	High
Thogoto TTC	Kiambu County, Nairobi Metropolitan Region	Medium-sized TTC	1,200–1,500 students	Medium
Narok TTC	Narok County, Rift Valley Region	Small TTC	700–900 students	Low

3.1.1. Key Informant Interviews

Key informants were drawn from the Ministry of Education, TSC, Ministry SAGAs, County Government and Universities. Table 2 outlines sampling for interviews with key individuals involved in policy, curriculum, and teacher education focused on numeracy. .

Table 2: Key Informant Interviews

Respondent Category	Criteria for Selection	Estimated Sample Size	Actual Sample size
KII with MoE Officer	Director-Teacher Education, Policy Development	2	2
KII with University-Based TPD	In charge of TPD	1	1
KII with CEMASTEIA Trainer	Trainers involved in in-service math education support	2	2
KII with TSC Officers	Focus on in-service	2	1
KII with KICD Officer	Officer in charge of primary numeracy curriculum	2	1
County-Level Officer	In charge of ECDE	1	1
KII with TTC Principals	From sampled institutions	3	3
TOTAL		13	11

3.3.2 Focused Group Discussion(s) and Lesson Observations

Table 3 outlines two qualitative data collection strategies used to complement the Key Informant Interviews (Table 2). These include Focus Group Discussion(s) and Lesson Observations..

Table 3: Data Collection Strategies

Data Collection Strategy	Respondent Category	Criteria for Selection	Estimated Sample Size	Sampling Method	Actual Sample size
Focused Group Discussion	Teacher Educators in TTC Tutors (Numeracy)	Teacher Educators of mathematics in public TTCs	9 Teacher Educators from 3 TTCs	Stratified purposive sampling	6 (2 per TTC)
Lesson Observation Guide	TTC Lesson Observations (Mathematics teacher Educators)	Mathematics lessons in pre-service training	9 lessons from 3 TTCs	Observation-based purposive	8 Mathematics Lessons

3.3.3. Desk Review

Policies and guidelines on education, curriculum, assessment, teacher education and development were purposively sampled for review.

3.4. Tools and Respondents

Based on the sampling design, data collection tools were developed to capture primary data through interviews. The following distinct tools were applied to guide desk review and draw key information and indicative statistics from the targeted respondents:

- a. **Policy audit Tool:** The tool guided the review of policies and guidelines and focused on the area of review, indicators, and findings/comments for each.
- b. **Lesson Observation Tool:** Teacher educators conducted numeracy lessons to selected groups of teacher trainees from various academic years. The tool used to guide the assessments included both qualitative and quantitative sections. The quantitative sections used a Likert scale of 1–5, with one being the lowest rating corresponding to the poorest score and 5 being an excellent score of the rating variable. Thus, a score of 3 would be moderate/average, and any score above 3 would be above average. The converse was true. The assessor would also score decimal fractions, e.g., 2.5, where deemed necessary to give a more precise reflection of the quality.
- c. **Stakeholder (Policy/Curriculum) Interview Tool:** This interview guide was used to explore the availability of policies on foundational numeracy, policy and curriculum alignment queries, curriculum preparation features, SEL integration, and macro strengths and gaps.
- d. **Teacher Educator Interview Tool:** This tool was used to engage teacher educators in a focus group discussion (FGD) on lesson preparation methods, instructional approaches, assessment integration, parental engagement initiatives, transition challenges, resource/training needs, SEL practices, and proposed improvements to the national policies.
- e. **Textbook Analysis Tool:** The tool guided the analysis of mathematics textbooks for PP1–Grade 3 and focused on: identification of numeracy topics/strands, cognitive skills as per Bloom’s Taxonomy Levels, problem-solving component, core competencies and values integration, and the use of mathematical language to support conceptual understanding and integration of mathematical reasoning. The tool provided for key gaps identified and comments.

4 Results and Discussion



This section presents and discusses the findings of the study under Component 4. The results include key findings from document analysis and policy reviews, as well as the information distilled from the primary data collected through FGDs and the teacher educator and stakeholder interview tools.

4.1. Findings from Curriculum and Policy Reviews

4.1.1. Gender of Respondents

Table 4 presents the gender distribution of the respondents who participated in the study, categorised by their roles.

Table 4: Gender of Respondents

Category	Male	Female	Total
Policymakers	4	7	11
KIIs Principals of TTCs	1	2	3
Teachers whose lessons were observed	5	2	7
Totals	10	11	23

The gender distribution across the different respondent categories—policymakers, principals of teacher training colleges (TTCs), and teachers whose lessons were observed—reveals a nuanced picture of gender representation within the foundational numeracy education landscape. Out of a total of 23 participants, 11 were female, and 10 were male, indicating a near gender parity with a slight female majority. This overall balance, however, masks variations across the different roles.

4.1.2. Findings from Document Analysis

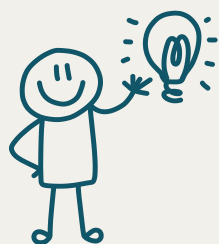
This analysis reviewed Kenya's key education policies and guidelines with provisions on numeracy. This analysis reviewed Kenya's key education policies and guidelines with provisions on numeracy. These included national policy documents, curriculum and assessment frameworks, and teacher education policies. The review examined four areas: (i) policy goals and strategies; (ii) provisions on numeracy; (iii) programmes supporting numeracy; and (iv) expected learner competencies.

The documents were compared against major global and regional standards for numeracy, including the Education 2030 Agenda, OECD Learning Compass (2023), UNESCO Global Proficiency Framework

(2019), International Standard Classification of Education (ISCED, 2011), International Standard Classification of Teacher Training Programmes (ISCED-T, 2021), UNESCO Global Framework of Professional Teaching Standards (2019), the African Teacher Qualification Framework (ATQF, 2019), and the Global Proficiency Framework for Mathematics (GPFM) Grades 1–9 (2020).

The review found that Kenya's overarching policy documents, Sessional Paper No. 1 of 2019 and the National Education Sector Support Programme (NESSP 2023–2027), provide broad provisions that can guide improvements in numeracy. More detailed frameworks, including the Basic Education Curriculum Framework (BECF, 2019), the Competency-Based Assessment Framework (CBAF, 2021), and the Kenya Integrated Early Childhood Development Policy Framework (KIECDF, 2017), outline specific pedagogical approaches (play-based, inquiry-based, and project-based), competencies, values, and assessment methods to inform teaching and learning. The Teacher Professional Development (TPD) Framework (2018) also reflects alignment with international benchmarks, drawing on both the Global Framework of Professional Teaching Standards (2019) and the ATQF (2019) emphasis on content knowledge, assessment practices, and integration of social-emotional learning (SEL).

Despite this progress, the analysis identified two key misalignments. First, Kenya's entry qualification for teachers remains at the diploma level, below the bachelor's degree requirement recommended in the ATQF (2019). Second, a disconnect exists between language policy and assessment: while early grade instruction is expected to use local catchment languages, national examinations are conducted in English, creating inconsistency between teaching and evaluation. The misalignment of language policy is further complicated by a lack of alignment with teacher deployment policy, as indicated by one of the policymakers:



“The ECDE policy page 16 gives direction on transition from home to school where children should learn in their [own] language. This is affected by posting of teachers.”

[KIIResp1]

The G-United initiative, a good practice on early numeracy, was implemented in Kenya in 2014, leveraging a national volunteering initiative that targeted fresh university graduates and was mainly aimed at improving national cohesion through cultural exchanges. The programme used the Volunteer Graduate Assistants (VGAs) to improve education outcomes through remedial support for students. The initiative provided valuable experience for volunteers and supported closing of learning gaps in literacy and numeracy. Leveraging existing initiatives for the integration of numeracy initiatives complements national initiatives to improve learning outcomes.

4.2. Findings from Key Informant Interviews

Key informants were identified from the Ministry of Education (MoE), SAGAs, County Early Childhood Education (ECDE) Officials, University lecturers involved in TPD, and TTC Principals. They were interviewed using a key stakeholder guide to gain insights on how well versed they were with the policies guiding quality delivery by the teacher education. The mostly open-ended questions provided adequate space for comprehensive articulation of the key issues and challenges.

1. *What policies exist to guide foundational numeracy in teacher training?*

This question assessed policymakers' level of awareness of existing national policies to guide foundational numeracy in teacher training.

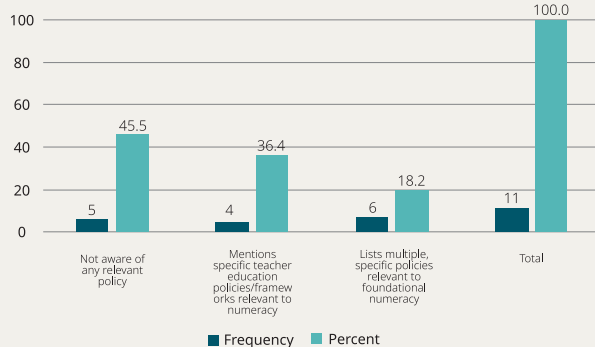


Figure 1: Policies that Exist to Guide Foundational Numeracy in Teacher Training

The findings indicated that almost half of the participants (45.5%) stated that they were not aware of any pertinent policies with provisions on numeracy. Partial awareness was shown by the fact that 36.4 per cent of respondents could name at least one pertinent teacher education framework or policy. Those who displayed thorough comprehension by enumerating several distinct policies that are closely related to numeracy were 18.2 per cent. College principals reported that there was no dedicated policy for foundational numeracy, showing little awareness of existing guidelines beyond the Basic Education Curriculum Framework and the NESSP 2023–2027. The policy documents mainly identified were: The Basic Education Curriculum Framework (2019), Sessional Paper No 1 of 2019, Report of the Presidential Working Party on Education Reform (2023), National Education Sector Support Plan 2023–2027, Curriculum designs, Competency Based Assessment Framework for Early Years Education (EYE) in Kenya (2021), Guidelines on Parental Empowerment and Engagement (2019), Kenya Integrated Early Childhood Development Policy Framework (March 2017) and Teacher Professional Development (TPD) Policy Framework (2018).

2. *To what extent do the policies provide for reforms in foundational numeracy?*

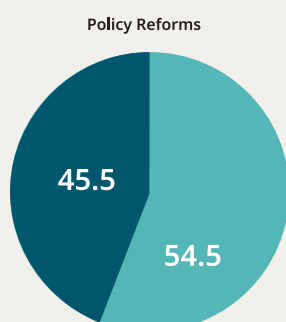


Figure 2: Policies that Support Reforms in Foundational Numeracy

The respondents were asked to confirm whether the policies provided for reforms in foundational numeracy. Of those who were aware, 54.5 per cent agreed that the policies provided foundational numeracy reforms, while 45.5 per cent held a contrary opinion. The nearly equal split suggests that stakeholders do not share a common understanding or awareness, which may be due to different interpretations of the policies' content or the fact that the policies are too general.

3. *Are current curriculum reform efforts aligned with international or regional standards (e.g., UNESCO, IEA)?*

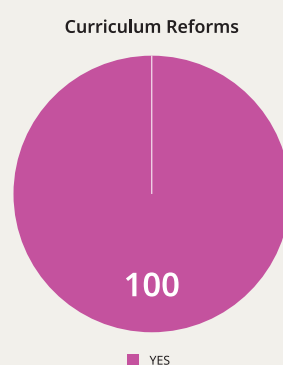


Figure 3: Curriculum Reforms Alignment with International or Regional Standards

The participants were asked to respond to the question of whether the current curriculum reform efforts aligned with international or regional standards. All participants reported that curriculum reforms were aligned with global standards. The reported alignment indicates that the intent and structure of curriculum reforms demonstrate an understanding of best practices globally, such as learner-centred pedagogy and inclusion of competencies like problem-solving, SEL, and formative assessment.

The curriculum reforms in Kenya that position numeracy as a foundational and cross-cutting skill are informed by the Basic Education Curriculum Framework (BECF) (2017) and aligned to the UNESCO UIS Global Proficiency Framework (GPF) (2020) regarding the scope and sequencing of strands and sub-strands for PP1–Grade 3 and the use of rubrics to determine proficiency. Findings from KII support this view, with one respondent indicating that CBE had enhanced trainee-centred initiatives: “CBE is

a major reform in education, especially with the inclusion of mathematical activities in the curriculum where the subject is activity-based.” [KIIResp2]. On demystifying mathematics, “In this college, mathematics is seen just like any other subject”. [KIIResp3]. Policy-level respondents involved in teacher retooling indicated gaps in the full adoption of trainee-centred approaches in practice.

4. How does the current TTC curriculum prepare teachers to deliver numeracy?

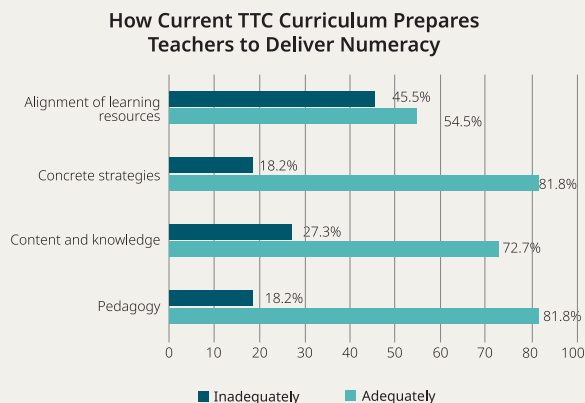


Figure 4: TTC Curriculum on Delivery of Numeracy

This question assessed how the current TTC curriculum prepares teachers to deliver numeracy. The results showed that pedagogical content (81.8%) and concrete teaching and learning strategies such as collaborative learning, inquiry-based learning, project-based learning, recognition of multiple intelligences, use of manipulatives and realia and gamification were adequately incorporated into the curriculum (81.8%). Key informants indicated that DPTE and DECTE programmes introduced in 2022 include enhanced micro teaching, theory and practice, mentorship and practicum. Teacher educators interviewed indicated that the longer duration of micro teaching practice had improved pedagogical skills, as indicated by Kimaro et al. (2022).

The TTC curriculum offers a strong foundation in mathematical content, as evidenced by the 72.7 per cent of respondents who thought that the curriculum appropriately addressed content knowledge for the delivery of numeracy. The alignment of resources component received the lowest rating, with only 54.5 per cent indicating that the learning resources were adequately aligned. Significant gaps in the availability, accessibility, or relevance of teaching and learning materials were indicated by the substantial 45.5

per cent who felt that this area was inadequate. The findings concur with sentiments from key informants’ interviews, who indicated that teacher educators’ resource materials were yet to be developed.

5. How are SEL and core values integrated into math education?

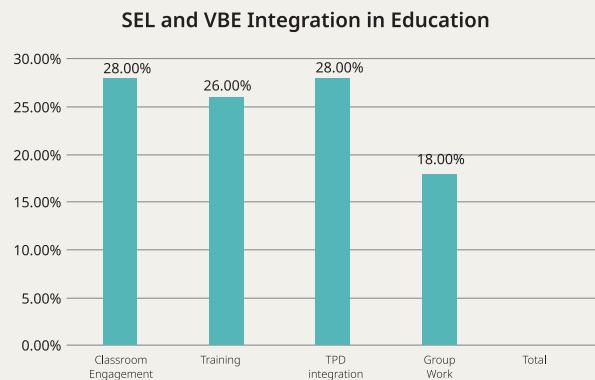


Figure 5: SEL and VbE Integration

The findings reveal that the integration of social-emotional learning (SEL) and core values into mathematics education is multifaceted, with four themes emerging from respondents’ accounts. The most prominent areas were classroom engagement, SEL-focused training, and TPD (Teacher Professional Development) integration, of which each accounted for between 26 and 28 per cent of responses. This suggests that SEL is increasingly recognised as a structured component of the curriculum and is embedded within mathematics learning objectives as curriculum designs provide for the integration of core competencies and values. This aligns with UNESCO’s (2021) emphasis on embedding SEL within subject content as part of the global drive for holistic education, where numeracy is not only cognitive but also social-emotional. Similarly, CASEL (2020) highlights that teacher training and professional development are essential entry points for equipping educators with skills to deliver SEL consistently across disciplines.

Groupwork emerged as a theme with slightly low prominence (18%), pointing to more practice-oriented dimensions of SEL integration. Groupwork reflects collaborative learning pedagogies widely endorsed in the literature (e.g., Vygotsky’s social-cultural theory and OECD’s 2018 framework on collaborative problem-solving), with emphasis on peer interaction as a foundation for both cognitive and social-emotional growth. The emphasis on

SEL integration, particularly through qualitative methods such as simulations and role-play, resonates with Value-based Education (VbE) models that encourage emotional and ethical reasoning in numeracy classrooms.

Taken together, the data suggest that while policies and frameworks formally recognise the importance of SEL in mathematics, the actual practices remain uneven. Stronger emphasis is needed on practical classroom strategies—such as collaborative activities and empathy-driven pedagogy—while ensuring systemic support through training, TPD, and structured induction.

6. *What are key gaps in Kenya's macro policy environment for supporting early numeracy?*

The participants reported observed conflicts between the policy on the use of catchment area language and guidelines on deployment, where teachers' proficiency in local languages is not considered, creating a gap in implementation. The Guidelines on Parental Engagement and Empowerment (PE&E) and Caregivers Training Manual that operationalises the PE&E guidelines outline strategies for implementing PE&E, including training of stakeholders, advocacy,

parent dialogues and enhancement of SEL. The guidelines are yet to be fully operationalised, occasioning low parental engagement (PWPER, 2023).

Weak implementation of the policy provisions on teacher educators' retooling, teacher support and mentorship, and establishment of communities of practice was also reported. Inconsistency in the conceptualisation of SEL in relation to VbE implementation in Kenya was evident through divergent views of respondents on their linkage. Furthermore, the mandated four-year textbook shelf life, which necessitates reuse by multiple cohorts of learners, diminishes the intended pedagogical value of the workbook features embedded in the textbook. While the TPD framework provides an opportunity to effectively and efficiently reach in-service teachers, it is yet to be fully implemented through the four institutions identified and accredited.

Findings depict policy development, alignment and implementation gaps requiring closure through the finalisation of the draft policies, harmonisation of existing ones and adoption of effective and efficient implementation approaches.



4.3 Key Findings from Policy Analysis

- i. **Alignment to global and regional frameworks and standards:** Policies and guidelines reviewed were relatively well aligned, with misalignments found in language policy and teaching entry requirements.
- ii. **Level of policy awareness:** Low level awareness of policies related to numeracy among policymakers and TTC Principals, hence the need to leverage opportunities such as TPD for continuous sensitisation.
- iii. **Competency-Based Education** is a major opportunity for improvement of numeracy through classroom practice, informal programmes and improved assessment. However, support for its implementation by the Government and partners remains inadequate. Sharing of knowledge and good practices is key to bridging the observed gaps.
- iv. **Key policies on teacher education** were found to be in the process of development.
- v. **Conflicts in existing policies** on the use of catchment area language, examination language and guidelines on deployment of teachers, hence the need for harmonisation.
- vi. **Gaps in the development and implementation of guidelines** on PE&E, teacher education and TPD requiring enhanced coordination and collaboration among key actors and uptake of good practices to close the gaps and foster improved implementation.

4.4. Analysis of PP1–Grade 3 Textbooks

This table presents the number of mathematics textbooks reviewed and the corresponding maximum number of sub-strands analysed per book, across five early learning grades (PP1 to Grade 3).

Table 5: Number of Mathematics Texts for PP1–Grade 3 and Sub-Strands Analysed

Grade	Number of textbooks	Maximum number of sub-strands per book
PP1	4	21
PP2	4	18
Grade 1	2	11
Grade 2	2	14
Grade 3	2	14
TOTAL	14	78

A total of fourteen (14) PP1–Grade 3 mathematics textbooks from four (4) different publishers with a maximum seventy-eight (78) sub-strands were analysed against key numeracy skills and component: Cognitive Skills Level (Bloom's taxonomy), emerging systemic approach to Numeracy, Problem Solving Component, SEL/Core values integration, use of mathematical language to support conceptual understanding, and integration of mathematical reasoning. The indicators for the skills and components were drawn from the CBAF (2021) and KICD curriculum designs. Table 6 shows the indicators of each of the skills and components.

Table 6: Indicators of Each of the Skills and Components

Skill/Component	Indicator	Maximum Occurrences
Cognitive skills	Bloom's Taxonomy–Remember, understand, apply, analyse, evaluate, create	6
Problem solving	Identifying problem, formulating problem, analysing problem, finding alternative solutions, choosing solutions, reflective thinking	6
SEL	Appreciation, self-awareness, self-esteem, communication, collaboration, ethical choices	6
Mathematical Language	Symbols, mathematical vocabulary, mathematical statements, mathematical theories/rules	4
Mathematical Reasoning	Conceptual understanding of concepts, procedural fluency, adaptive reasoning, deductive reasoning	4

Each of the strands, prenumber, number, measurement, and geometry was analysed, and occurrences of the skills per grade tabulated. The results were as follows.

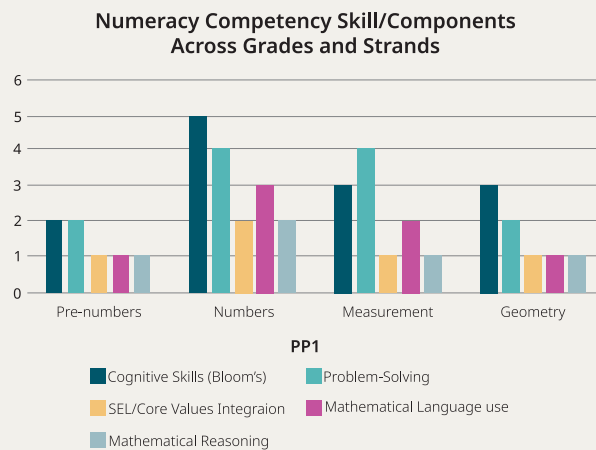


Figure 6: Numeracy Competency/Components in PP1

The analysis indicates that the Numbers strand dominated in emphasis, especially in areas such as cognitive skills, problem-solving, and mathematical language use. This reflects the centrality of number sense in early learning; the treatment remains broad and largely procedural, with limited evidence of opportunities for children to deepen their conceptual understanding of numeracy. Foundational numeracy extends beyond exposure to numbers; it requires building a flexible number sense, such as comparing quantities, understanding part-whole relationships, decomposing numbers, and applying operations meaningfully to real-life contexts.

In contrast, the strands of Measurement and Geometry were only moderately covered, often serving as applied contexts for counting or recognising shapes, rather than as domains that reinforce underlying numeracy concepts. For example, measurement could provide rich opportunities to strengthen proportional reasoning or estimation, but this is not fully drawn out in the curriculum materials reviewed.

A notable gap is the minimal integration of Social and Emotional Learning (SEL) and core values within numeracy instruction. Yet, global standards emphasise the effective dimension of numeracy learning, where collaboration, persistence in problem-solving, and ethical decision-making are critical in fostering lifelong mathematical confidence. The limited integration of SEL reduces opportunities for cultivating deeper reasoning, communication, and resilience. Opportunities to strengthen number sense through varied contexts, scaffold conceptual understanding in Measurement and Geometry, and embed SEL into everyday numeracy activities remain underutilised.

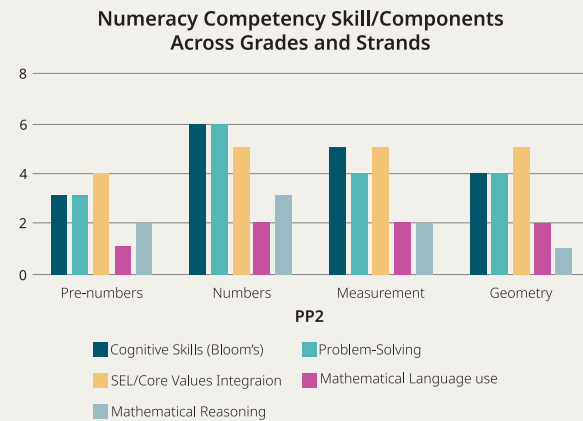


Figure 7: Numeracy Competency/Components Across Strands in PP2

Compared to PP1, there was a strong increase in coverage of the skills and components across all strands in PP2. The Numbers strand continued to lead, showing the highest scores overall, with significant emphasis on cognitive skills and problem-solving, both scoring six instances. Notably, Social and Emotional Learning (SEL) also rose sharply in this strand, appearing five times, alongside a moderate focus on mathematical reasoning.

Measurement and Geometry showed improved integration, particularly in relation to SEL, suggesting a broader and more holistic instructional approach. Overall, PP2 demonstrated a more balanced emphasis between cognitive and social-emotional learning, marking a clear shift from basic exposure in PP1 to more integrated and skill-oriented development.

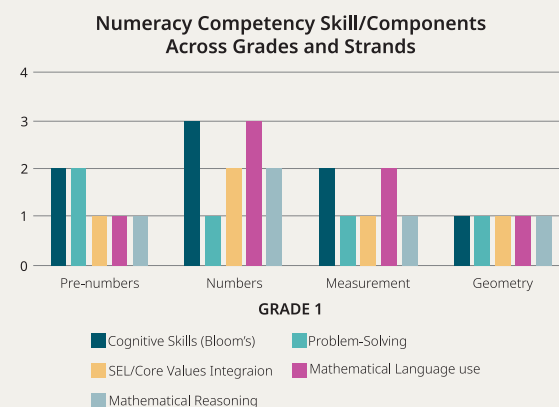


Figure 8: Numeracy Competency/Components Across Strands in Grade 1

Compared to PP2, there was a noticeable drop in the skills/components emphasised across

nearly all competencies. While the Numbers strand continued to record the highest values, the intensity of focus was reduced, potentially indicating a shift towards reinforcement rather than new skill development. Of essence is the improved scores on SEL integration.

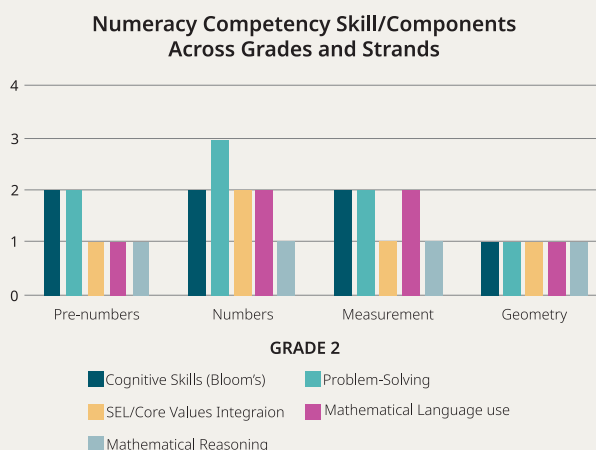


Figure 9: Numeracy Competency/Components Across Strands in Grade 2

This level maintained low to moderate values across most competencies, with a slight recovery observed in specific areas. Problem-solving within the Numbers strand showed a modest improvement, appearing three times. Similarly, mathematical language use registered 2 to 3 instances across various strands, indicating a gradual reintroduction of new concepts. However, Geometry registered the least variety of skills and competencies, which was expected due to the minimal course content. These results were expected as in this grade, learners progressively move to higher abstract mathematical concepts and deepen their reasoning..

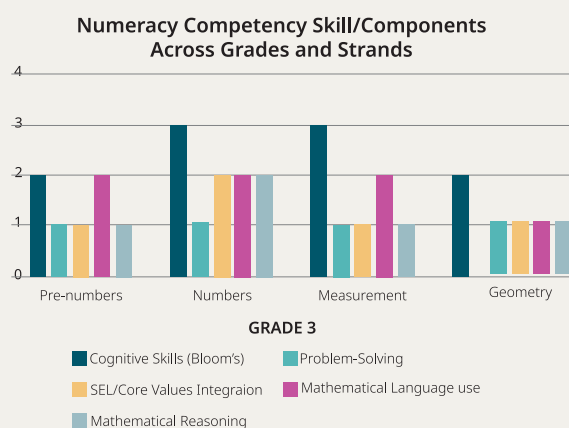


Figure 10: Numeracy Competency/Components Across Strands in Grade 3

The data reflected a continued low trend from Grades 1 and 2, with only modest consistency observed in the Measurement and Numbers strands, particularly in cognitive skills and mathematical language use. Despite this, Social and Emotional Learning (SEL) and reasoning remained significantly underrepresented. The high scores in cognitive skills were expected as learners are exposed to a broad range of mathematical concepts. The persistent low levels of SEL integration may indicate that curriculum and instruction at this level prioritise procedural knowledge over holistic skill development.

A general observation of the materials indicated that textbooks adopted the use of mathematical representations, including coloured drawings and diagrams to illustrate abstract concepts and integrate application into the real world (Evans et al., 2019). The scope and sequencing of strands and sub-strands were fully aligned to the GPFM (2020) proficiency descriptors per grade, with the initial sub-strands in every grade focusing on a review of key concepts in the previous level. Digital skills integration was evident but inconsistent across publishers, strands, and levels. To create seamless flow from curriculum designs to lesson delivery and ease integration of effective methodologies for numeracy, such as scaffolding and use of manipulatives, development of simplified teachers' guides that directly support lesson delivery is imperative (UNESCO, ADEA, & African Union, 2022).

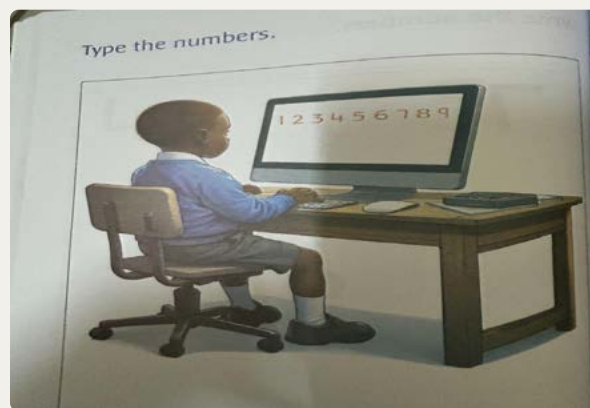


Figure 11: Extract from a Book: Illustration on Writing Numbers Using A Digital Device

4.5. Key Findings from Textbook Review

1. **Uneven coverage across grades:** PP1 and PP2 showed relatively strong emphasis on cognitive skills, problem solving, and mathematical language, especially in the Numbers strand. However, Grades 1 to 3 showed a progressive decline in integration of competencies, with reinforcement of prior knowledge prioritised over introduction of new or higher-order skills. This indicates a disconnect between early gains in PP2 and the sustained development of holistic numeracy skills in primary grades.
2. **Dominance of the numbers strand:** Numbers consistently received the highest attention across all grades, overshadowing other strands. Geometry and Measurement were underrepresented, particularly in Grades 2 and 3, which may limit exposure to spatial reasoning and real-life application contexts.
3. **Weak social and emotional learning (SEL) / Core values integration:** There was minimal SEL and values integration in PP1, with noticeable improvement in SEL inclusion, especially within Numbers and Measurement. In Grades 1–3, SEL focus dropped significantly, suggesting that holistic learning is not systematically embedded across the progression. This reflects a missed opportunity to link numeracy with empathy, collaboration, persistence, and a growth mindset.
4. **Limited mathematical reasoning:** Mathematical reasoning (explaining why, justifying steps, making connections) appeared sporadically across the strands, indicating an inclination towards procedural practice rather than conceptual reasoning at higher levels (Grades 1–3), constraining learners' ability to apply knowledge flexibly.
5. **Problem-solving emphasis inconsistent.** This was strong in PP1–PP2, particularly within the Numbers strand, but declined in Grades 1–3, with only modest instances in Grade 2 indicating a reduction in learner opportunities to engage with authentic, real-life mathematical challenges as they progress.
6. **Inconsistent ICT integration across strands:** Leveraging ICT for numeracy improved learner engagement and achievement of learning outcomes by concretisation of abstract concepts, increased opportunities for manipulatives, problem-solving and reflection.

4.6. Findings from Lesson Observations

The field visit exercise involved lesson observations to act as a gauge of the actual delivery by teacher educators against best practices. In summary, the best practices feature a practical package for strengthening early numeracy by:

- i. **Opening every lesson with a tight Recall (RC) → Hook → Misconception-Probe → Key Inquiry Question (KIQ)** routine to activate prior knowledge, surface likely errors, and focus inquiry;
- ii. Teaching through **Concrete–Pictorial–Abstract (CPA) progressions using manipulatives and representations** selected to reveal structure (e.g., base-ten blocks, number lines, simple balances), then **fade** them so pupils can generalise to symbols;
- iii. Making **formative assessment** routine—brief checks, actionable feedback, and adapting teaching in real time;
- iv. Differentiating using **Teaching at the Right Level** (scaffolding and sequencing – group by current attainment and move learners up as they master) to close foundational gaps efficiently; and
- v. Supporting teachers with **clear mathematical goals, rich tasks, and discourse** while expanding **digital equity** (offline **Open Educational Resources** (OER)/device banks) so activity-based methods are consistently resourced.

International evidence backs each element: manipulatives/representations raise understanding when purposefully chosen and connected to abstraction (and should not become a crutch), CPA sequencing builds deep conceptual grasp (Bruner), and formative assessment is among the most powerful levers for learning.

4.6.1. Summary of Lesson Observations

A total of eight (8) lessons were observed in three target colleges. Across the three TTCs, there was variation in the linkage of the current lesson to previous lessons and knowledge.

Table 7: Evaluation of Lesson Observation

Evaluation of Lesson Observations (1 = poorest; 5 = excellent)									
Lesson	lesson I	lesson II	lesson III	lesson I	lesson II	lesson III	lesson I	lesson II	Overall
Lesson introduction									
Linkage to previous lesson	4	4	4	5	2	2.5	2	2	3.2
Linkage to previous knowledge	4	4	4	4	2	3	2	3	3.3
Stimulating learner interest	3	3	5	3	2	3	2	2	2.9
Focusing learners to specific learning outcome – Key Inquiry Questions (KIQs)	2	3	3	5	1	1	4	3	2.8
	3.3	3.5	4.0	4.3	1.8	2.4	2.5	2.5	3.0
Overall rating	3.6			2.8			2.5		3.0
Use of instructional aids – manipulatives and visual aids	1	3	4	3	3	5	3	1	
Overall rating	2.7			3.7			2.0		2.8
Engagement strategies – Questioning, group work, individual activities	3	4	4	3	4	4	3	3	
Overall rating	3.7			3.7			3.0		3.4
Content mastery (CK)	5	5	4	4	4	5	4	4	
Teacher demonstrates ability to break down complex concepts into simple steps to ease mastery by students									

Evaluation of Lesson Observations (1 = poorest; 5 = excellent)									
Lesson	lesson I	lesson II	lesson III	lesson I	lesson II	lesson III	lesson I	lesson II	Overall
Proper use of mathematical language Use of examples, scaffolding									
Overall rating	4.7			4.3			4.0		4.3
Systematic delivery (PK)	3	5	4	3.5	3	4	5	3	
Movement from concrete, semi-abstract to abstract									
Logical sequencing/ flow of ideas/ concepts (from simple to complex)									
Giving formative feedback									
Reinforcing learners' feedback									
Highlighting key points									
Responding to learner(s) question(s) accurately									
Overall rating	4.0			3.5			4.0		3.8
Approach and methodology	3	5	3	4	3.5	4	4	3	
Probing learner student thinking and reasoning in relation to the stipulated content									
Encouraging diverse problem-solving strategies									
Probing to build a deep understanding of maths concepts									
Overall rating	3.7			3.8			3.5		3.7

Evaluation of Lesson Observations (1 = poorest; 5 = excellent)									
<i>Lesson</i>	<i>lesson I</i>	<i>lesson II</i>	<i>lesson III</i>	<i>lesson I</i>	<i>lesson II</i>	<i>lesson III</i>	<i>lesson I</i>	<i>lesson II</i>	<i>Overall</i>
SEL integration Empathy – The teacher models ability to understand the emotions and concerns of learners during the lesson Collaboration – How does the teacher facilitate learners working together to collaboratively finish tasks, e.g., work on a mathematical task together and collaboratively come up with a solution? Confidence building, e.g., through reflecting learner questions to their fellow learners Self-efficacy, e.g., exploring incorrect answers and solving them to build mathematical reasoning	3	4	2	4	2	3.5	4	2	
Overall rating	3.0			3.2			3.0		3.1
Inclusivity How does the teacher integrate learners with special needs and those who require more time?	3	5	3	3	1	1	2.5	2	
Overall rating	3.7			1.7			2.3		2.5
Environment Does the learning environment indicate a focus on numeracy, e.g., posters, visuals?	2	3	3	3	2	3	3	3	

Evaluation of Lesson Observations (1 = poorest; 5 = excellent)									
Lesson	lesson I	lesson II	lesson III	lesson I	lesson II	lesson III	lesson I	lesson II	Overall
Does the teacher integrate the cultural environment into the lesson?									
Overall rating	2.7			2.7			3.0		2.8
Feedback and assessment	3	5	3	4	3.5	4	3	4	
Checking understanding, take-away tasks related to the learning outcome									
Overall rating	3.7			3.8			3.5		3.7

4.6.2. Engagement Strategies and Learner Interest Stimulation

Across the observed lessons, teachers employed varied strategies to engage learners, though with mixed consistency and effectiveness. Exemplary approaches involved grounding a lesson on “linear inequalities” on real-life scenarios within the school, sparking interest effectively, using an abacus as a learning aid for early numeracy, particularly in addition, using a beam balance to demystify algebraic expressions, and group coaching. Conversely, three of the observed lessons lacked deliberate strategies to ignite learner curiosity, overly relying on teacher voice modulation rather than structured engagement methods.



Figure 12: A Good Example of Using an Abacus as a Learning Aid. Machakos TTC. July 10, 2025



Figure 13: Group Coaching Among Teacher Trainees. Machakos TTC. July 10, 2025



Figure 14: Innovative Use of a Beam Balance to Demystify Algebraic Expressions. Narok TTC. July 17, 2025

4.6.3. Clarity of Key Inquiry Questions and Learning Objectives

A Key Inquiry Question (KIQ) is a concise, learner-friendly question that frames the central mathematical idea as a problem to solve. It benefits from open-ended, relatable contexts and embeds the target concept in everyday language and practice. Clear articulation of key inquiry questions or explicit learning outcomes was inconsistent, limiting learner clarity and focus. Though some lessons successfully linked content with relatable contexts, others presented curriculum-design outcomes without adequate contextualisation, underscoring a need for clearly framed, learner-centred outcomes.

4.6.4. Inclusivity and Differentiated Instructional Approaches

Inclusivity practices differed notably across lessons. Caring for learners who need more time because of their special needs took the form of an intentional regulation of the pace of instruction and supporting trainees with different learning capacities, including those with disability and the gifted, to participate in solving problems at their pace. While some effectively used group activities and tailored individual support, fostering participation and confidence, at least one session lacked evident inclusive strategies. This variation highlights the necessity for intentional lesson planning that caters to diverse learning paces. For mixed-ability synergies, such a corrective intervention is essential.

4.6.5. Progression from Concrete to Abstract Concepts

Most teachers systematically progressed from familiar real-world contexts to semi-abstract and on to abstract mathematical concepts, such as moving from tangible examples of inequalities to symbolic expressions, or from simple algebraic expressions to ones that require more rationalisation. However, this was not uniformly applied; certain lessons, such as one case on quadratic equations, immediately delved into abstract content with limited real-world connections, though clarifications were typically provided.

4.6.6. Learner-Centred Approaches

Learner-centred methods varied widely in effectiveness. Effective lessons promoted divergent thinking, peer collaboration, and gradual learner autonomy through structured activities. Yet, some sessions saw passive learner participation due to insufficient deployment of varied instructional strategies and limited conceptual exploration.

4.6.7 SEL Integration

Social-Emotional Learning (SEL) elements were inconsistently integrated. While some lessons demonstrated effective use of affirming language and positive peer interactions, others did not intentionally address SEL, indicating the need for systematic embedding of these aspects.

4.6.8. Classroom Environment and Learning Resources

Classroom environments and resource availability significantly impacted instructional effectiveness. Congested spaces and insufficient numeracy aids restricted group interactions and teacher mobility in several lessons. Although a few classrooms facilitated group activities, there was a notable lack of culturally relevant visual resources and numeracy materials, pointing to critical areas for improvement.

4.6.9. Feedback and Formative Assessment Practices

Feedback strategies were inconsistently employed across observed sessions. Effective lessons featured structured group tasks and student demonstrations with verbal feedback, positively enhancing learner engagement. Conversely, several lessons lacked structured feedback opportunities, diminishing formative assessment effectiveness. One innovative takeaway task involving observations and community engagement in the surrounding pastoral community demonstrated the potential for extending assessment beyond classroom boundaries, underscoring the value of integrating feedback consistently.



4.6.10 Key Observations

- i. **Activity** and **project-based approaches** were progressively replacing rote learning, but the use of **manipulatives and digital content** for deepening mathematical concepts was irregular.
- ii. **Role playing and group learning** with arrangements for **peer-to-peer exchange** were gaining ground as part of the new delivery mechanisms meant to enhance pedagogy.
- iii. Evidence from the three Teacher Training Colleges showed solid **teacher content knowledge** but systemic gaps in lesson delivery, inclusivity practices, and resource equity.
- iv. Weak **integration of concrete examples from the social and cultural environment**, hence missed opportunities for demystifying, socialising, and popularising numeracy among trainees.

4.7. Findings from Teacher Educator FGDs

A focus group discussion (FGD) with teacher trainers explored teacher content knowledge and exposure to emerging trends, structural challenges, and gaps in lesson delivery methods, inclusivity practices, and learning resources in terms of adequacy and equity. From the teacher educator reports, with complementing evidence from students' feedback in one of the TTCs, it was evident that low achievement in early numeracy persists in Kenya despite the CBC roll-out. Digital divide has mainly been on hardware/connectivity and not on skills, because the learners are mostly digital natives. The following granular findings arose from the focus group discussions with the teacher educators from the three colleges.

4.7.1. Instructional Preparation and Pedagogy

Teacher educators favoured activity-oriented methods such as role-play, concrete objects, micro-teaching, and locally organised symposia, designed to make mathematics visible and tangible. Emphasis fell on problem-solving, play-based learning, differentiation of learner approaches based on specific special needs or synergy building, and the gradual extension of practicum and extracurricular experiences into authentic community contexts.

4.7.2 Assessment and Conceptual Anchors

Assessment practice anchored on practical application. For example, fabricating a beam balance and an abacus worked to build procedural fluency while grounding abstract ideas. These tasks were deliberately linked to methodology development, ensuring students learnt both "the math" and "how to teach the math."

4.7.3. Parental Engagement

Home-based extensions require signatures from parents, but involvement remained largely transactional rather than participatory. Teacher-educators identified the need for targeted programmes on parental engagement for teacher trainees and workshops for parents to transform compliance into constructive support.

The KICD Guidelines on Parental Empowerment and Engagement (2019) indicate that parents should be represented and actively engaged in all relevant decision levels in schools. The guideline outlines strategies for implementing PE&E, including training of stakeholders, advocacy, and parent dialogues. The Caregivers Training Manual (2020) aims to operationalise the PE&E guidelines. The teacher educators interviewed indicated that the guidelines were yet to be implemented at the institutional level.

4.7.4. Structural and Transitional Challenges

The shift from the 8-4-4 system to Competency-Based Education (CBE) demands considerable unlearning and relearning. Large classes (often above the 30–35:1 student/teacher ratio target), language barriers, and textbook gaps compound the difficulty, while external numeracy coaching programmes such as the SMASSE and EGMA lack a sustainability mechanism.

4.7.5. Resource and Capacity Needs

Tutors pinpointed ICT retooling, e.g., laptops, refreshed computer labs, and reliable projectors as the most urgent requirement. They also called for standardised employment of ECD teachers, sustained CPD, digital literacy integration, and the development of low-cost, locally sourced manipulatives to bridge resource inequities.



4.7.6. Key Observations

- i. **Parental engagement and involvement** remain largely transactional rather than participatory.
- ii. **Targeted programmes** on parental engagement for teacher trainees and workshops for parents to transform compliance into constructive support.
- iii. **High trainee/teacher educator ratio** diminishes the effective use of collaborative and peer-to-peer approaches for learning
- iv. **Expanded ICT infrastructure and sustained CPD** on digital literacy for improved ICT integration by teacher trainees.
- v. **Formative assessment practice** anchored on practical application through microteaching.

4.8 Proposed Collaboration Framework for Foundational Numeracy in Kenya

To enhance coordination and build synergy among the multisectoral actors in foundational numeracy, a collaborative framework that leverages multilevel engagements is imperative. UNESCO, ADEA and the African Union (2022) indicate the critical role played by government national-level stakeholders in providing political support and technical guidance for foundational numeracy initiatives. MoE is a key stakeholder, with the mandate for providing national policy guidance on foundational numeracy, while the county governments play a major role in the implementation of programmes and infrastructure development. In view of the CBE reforms in the country, KICD, KNEC and CEMASTE, specialised agencies that support numeracy, will provide critical technical support at the national level to articulate and promote a clear vision for foundational numeracy initiatives, ensure linkage with existing government programmes and support alignment with government priorities. Misalignment of mandate among stakeholders at this level is a key concern that requires mitigation, especially regarding teacher management (PWPER, 2023).

Development partners' support from organisations such as: the Global Partnership for Education, the Gates Foundation, World Bank, the UK's Department for International Development (DFID), and the International Development Research Centre (IDRC) remain important as potential accelerators for policy discussions and linkage of foundational learning to emerging global best practices but need to be oriented towards institutional building and sustainable interventions (UNESCO, ADEA, & African Union, 2022). The engagements need to sustain linkages with global outfits such as the UNESCO Global Coalition for Foundational Learning (GCFL), which map potential programmes for global support to ensure sustainable programming. To advance evidence-based practices, universities and research institutions would contribute evidence through continuous evaluation of observation practices (Darling-Hammond et al., 2017).

Middle-level tier officers in education who operate between the central ministry and individual schools, Sub-County Education Officers (SCEO), Quality Assurance and Standards Officers (QASOs) and Curriculum Support Officers (CSOs), play a crucial role in supporting the scale-

up of learning outcomes, acting as mentors, coaches, or network facilitators (UNICEF, 2024). The officers, however, have limited resources, competing priorities (from assessments, donor projects, management meetings), logistical barriers (such as inadequate office space, digital tools, mobility to schools), and a need for strong instructional leadership. These challenges can hinder the ability of middle-tier professionals to effectively support teachers and improve student outcomes (UNESCO IIEP, 2025).

Institutional-level actors, including HOIs/ Principals and teacher educators/teachers, led the implementation of numeracy initiatives at the TTIs and schools, respectively, positioning them as role models for reducing education inequality in foundational learning (UNESCO, ADEA, & African Union 2022). This role is critical for improving classroom instruction, school-based monitoring and reporting, peer support and mentorship, remediation, and the development of institutional guidelines to inform foundational numeracy (Jefferson, 2022). Collaborative initiatives, such as School-Based Teacher Support (SBTS) and lesson study approaches, provide opportunities for professional learning communities and peer observation models at the institutional level (Akiba, 2013). The TTCs are critical for supporting regular interplay between teacher training and schools for continuous alignment and support. One of the principals interviewed expressed interest in having a linkage with schools beyond the practicum. Challenges at this level include low instructional leadership, pedagogical and coaching skills, inadequate capacity development opportunities, weak parental involvement and engagement.

There is an emerging reservoir of local-level CSOs that support institutional-level initiatives through remediation, supplementing government through the recruitment of teachers to address large class sizes and staff deficits. The initiatives require coordination and packaging for policy attention as good practices.

The KICD Parental Empowerment and Engagement guidelines outline parents' involvement in improving learning outcomes through support to their children, awareness of the learning outcomes of their children and clear feedback channels. The guidelines are, however, yet to be fully operationalised as indicated by policymakers interviewed in this study. Some parents lack capacity for effective engagement, while others are too busy for this role. The school community can serve to support school

instruction, especially through harnessing local opportunities for improved foundational numeracy (Kumar et al., 2024).

In view of the above findings, the following collaborative framework is proposed.



Figure 15: Collaborative Framework

5 Conclusions & Recommendations



5.1. Conclusions

Kenya's teacher education ecosystem for foundational numeracy stands at a decisive inflection point, with teacher educators already pivoting towards learner-centred, activity-rich, and digitally supported pedagogy, with initial steps towards the integration of social-emotional learning (SEL). However, policy invisibility, resource inequities, and inconsistent lesson-quality routines still blunt the system's transformative potential.

The policies and curricula informed by global best practices are in place, but their potential remains largely untapped due to low pedagogical skills among teacher educators. Low SEL integration in teacher education and learning resources was evident. By bridging the gaps in teacher preparation and development, strengthening SEL and problem-solving skills, enhancing alignment of policies and learning resources with global benchmarks, and fostering inclusive, well-supported learning environments, the country can unlock the full promise of early numeracy for every child.

5.2 Recommendations

Policy

- i. The Ministry of Education should put in place policy guidelines for foundational numeracy to support institutional-level guidelines, finalise teacher education policies to guide teacher education, and harmonise conflicting policies.
- ii. The Teacher Training Colleges (TTCs) should adopt effective policy awareness creation mechanisms.

Teacher Education

- i. Research bodies should conduct a deeper assessment of teacher trainee knowledge and skills to establish the impact of emerging capacity in TTCs.
- ii. The TTCs should institute tailor-made CPD programmes for Teacher Educators geared towards enhancing teacher pedagogical capacity, fostering DEI and deepening mathematical concepts.
- iii. The TTCs should strengthen SEL and problem-solving skills through structured teacher guides and leverage existing opportunities in the curriculum.

Learning Materials

- i. The TTCs should develop structured teacher guides for early years mathematics to support curriculum interpretation, teacher preparation, and integration of SEL.
- ii. The tutors should integrate lesson exemplars that adopt a scaffolding model and integrate ICT, pre-empt students' common errors, and improve both formative and summative assessment.

6. References

- Akiba, M. (2013). *Teacher reforms around the world: Implementations and outcomes*. International Journal of Educational Research, 62, 1–12.
- Araujo, M. C., Carneiro, P., Cruz-Aguayo, Y., & Schady, N. (2016). *Teacher quality and learning outcomes in kindergarten*. Quarterly Journal of Economics, 131(3), 1415–1453.
- Bell, M., & Cooper, P. (2013). *Peer observation of teaching in university departments: A framework for implementation*. International Journal for Academic Development, 18(1), 60–73.
- Black, P., & Wiliam, D. (2009). *Developing the theory of formative assessment*. Educational Assessment, Evaluation and Accountability, 21(1), 5–31.
- CASEL. (2020a). SEL: *What are the core competencies?* Collaborative for Academic, Social, and Emotional Learning. <https://casel.org/core-competencies>
- CASEL. (2020b). *What is SEL?* Collaborative for Academic, Social, and Emotional Learning. <https://casel.org>
- Claessens, A., & Engel, M. (2013). *How important is where you start? Early mathematics knowledge and later school success*. Teachers College Record, 115(6), 1–29. <https://doi.org/10.1177/016146811311500603> (Original work published 2013)
- Darling-Hammond, L., Hyster, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Palo Alto, CA: Learning Policy Institute.
- Evans, N., Srikantaiah, D., Pallangyo, A., Sugrue, M., and Sitabkhan, Y. (2019). *Towards the design and implementation of comprehensive primary grade literacy and numeracy programs. A Working Paper by the Global Reading Network*. Prepared by University Research Co., LLC. (URC) under the Reading within REACH initiative for USAID's Building Evidence and Supporting Innovation to Improve Primary Grade Assistance for the Office of Education (E3/ED). Available at www.globalreadingnetwork.net.
- Government of Kenya. (2024). *Guidelines for development of national government policy and legislation*. Government of Kenya.
- GPE. (2020). *Foundational learning: Ensuring every child is prepared to thrive in school and life*. Global Partnership for Education.
- Grossman, P., Loeb, S., Cohen, J., & Wyckoff, J. (2013). *Measure for measure: The relationship between measures of instructional practice in middle school English Language Arts and teachers' value-added scores*. American Journal of Education, 119(3), 445–470.
- Kenya Institute of Curriculum Development. (2017). *Basic education curriculum framework*. Nairobi: Kenya Institute of Curriculum Development.
- Kenya Institute of Curriculum Development. (n.d.). *Age-based regular curriculum framework*. Nairobi: KICD.
- Kpanja, E. (2001). *A study of the effects of video tape recording in microteaching training*. British Journal of Educational Technology, 32(4), 483–486.
- Ministry of Education. (2017). *Kenya Integrated Early Childhood Development Policy Framework*. Nairobi: Government of Kenya.
- Ministry of Education. (2019). *Guidelines on parental empowerment and engagement*. Nairobi: Government of Kenya.
- Ministry of Education. (2019). *Sessional Paper no. 1 of 2019 on a policy framework for reforming education and training for sustainable development in Kenya*. Nairobi: Government Printer.
- Ministry of Education. (2023). *National Education Sector Strategic Plan (NESSP) 2023–2027*. Nairobi: Government of Kenya.
- Ministry of Education. (2023). *Report of the Presidential Working Party on Education Reform*. Nairobi: Government of Kenya.

- Ministry of Education. (n.d.). *Pre-service Teacher Training Curriculum (Mathematics)*. Nairobi: Government of Kenya.
- Ministry of Education. (n.d.). *Teacher training institutional guidelines (Guidelines on management of practicum, practicum observation tool, and institutional-based teacher educators induction guidelines)*. Nairobi: Government of Kenya.
- Ministry of Education. (n.d.). *Textbook policy and guidelines*. Nairobi: Government of Kenya.
- MoE India. (2021). *Foundational literacy and numeracy (FLN) mission*. Ministry of Education, Government of India.
- MoE. (2019). *National ICT in education policy*. Nairobi: Ministry of Education.
- MoE. (2021). *Competency-based education framework for early years*. Nairobi: Ministry of Education.
- OECD. (2018). *The future of education and skills: Education 2030*. Organisation for Economic Co-operation and Development. <https://www.oecd.org/education/2030>
- OECD. (2019). *A flying start: Improving initial teacher preparation systems*. Paris: OECD Publishing.
- Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008). *Classroom Assessment Scoring System (CLASS)*. Baltimore: Paul H. Brookes.
- Piper, B., Sitabkhan, Y., Mejia, J., & Betts, K. (2018). *Effectiveness of structured pedagogy in improving learning outcomes: A meta-analysis*. RTI International.
- RTI. (2020). *Teaching at the right level: A review of evidence and practice*. RTI International.
- Strong, M. (2011). *The highly qualified teacher: What is teacher quality and how do we measure it?* New York: Teachers College Press.
- The National Treasury and Economic Planning. (n.d.). *Bottom-up economic transformation agenda for inclusive growth: Medium Term Plan IV (MTP 4)*. Government of Kenya.
- Teachers Service Commission (TSC). (2018). *Teacher professional development (TPD) policy framework*. Teachers Service Commission, Kenya.
- UNESCO. (2019). *Global proficiency framework for reading and mathematics (Grades 2 to 6)*. United Nations Educational, Scientific and Cultural Organization
- UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000379707>
- UNESCO International Bureau of Education. (2017). *A guide for ensuring inclusion and equity in education*. <https://unesdoc.unesco.org/ark:/48223/pf0000248254>
- UNICEF. (2020). *Learning and skills for children and adolescents: Global framework*. New York: UNICEF.
- Uwezo. (2021). *Are our children learning? Literacy and numeracy across East Africa*. Nairobi: Twaweza East Africa.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- World Bank. (2021). *Kenya: Learning poverty brief*. Washington, DC: World Bank.



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