TRACKING CHANGE IN FOUNDATION PHASE MATHS TEACHING AND THE IMPACT ON CHILDREN'S LEARNING



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Introduction

Mathematics education in South Africa has long been a subject of significant concern (Reddy, 2006; Fleisch, 2008; Spaull & Kotze, 2015). The consistently poor performance of learners in mathematics is well documented, both in national studies and international assessments (Spaull & Kotze, 2014; Bansilal, Brijlall & Mkhwananzi, 2014). Measures such as the Trends in International Mathematics and Science Study (TIMSS), the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ), and various systemic evaluations have repeatedly highlighted low levels of mathematics achievement across the country (Spaull, 2013).

A growing body of literature attributes this persistent underperformance to ineffective teaching practices. This crisis is laid early in the Foundation Phase says Graven (2013), where learners begin acquiring the basic numeracy skills essential for future mathematical learning. These findings underscore the urgent need for interventions aimed at strengthening mathematics instruction, particularly at the early stages of schooling.

In response, the Primary Science Programme (PSP) implemented a structured professional development (PD) initiative targeting Foundation Phase teachers in disadvantaged schools. This paper examines the suite of tools and methodologies employed within the PSP Mathematics Programme, with a particular focus on their design, implementation, and the nature of the data generated.

Objective

Reviews of intervention plays a critical role in determining the effectiveness of specific treatments, programmes, or educational approaches, especially insofar as establishing whether they are achieving their intended outcomes or not. Queensland (n.d.) advises that if positive results are not being realized, it is necessary to reflect on and revise existing practices within the programme.

In light of this, the present paper reviews the tools and methodologies employed in PSP's Cluster Project, with a particular focus on their implementation, data generated, and subsequent analysis. The review aims to:

- Assess the effectiveness of the tools for tracking teacher PD and impacts of the project inputs on mathematics teaching and learning.
- Evaluate the reliability and trustworthiness of the information provided.
- Determine whether the tools require refinement or should be discontinued.

This review is a crucial step for the PSP, as it provides an evidence-based foundation for making informed decisions about future interventions.

Literature Review

Atweh, Bose, Graven, Subramanian, and Venkat (2014) stress that while limited content knowledge impedes mathematics instruction, content knowledge alone is not enough. They highlight the need for improved pedagogical content knowledge, which enables teachers to connect subject matter meaningfully to learners' contexts and prior knowledge.

Inadequate resourcing, large learner numbers and ineffective teaching strategies appear ongoing challenges. Drews (2007) and Venkat and Askew (2013) emphasise the vital role of teachers' strategies and appropriate resources in supporting young learners' mathematical understanding. Despite some progress, many classrooms still lack basic materials such as textbooks and workbooks.

Research Methods

This study employed a mixed methods case study design (Creswell, 2014) to explore the effectiveness of the tools used in PSP's Cluster Project. The mixed methods approach, which integrates both quantitative and qualitative research strategies, is well regarded for its ability to produce comprehensive, reliable, and rigorous findings (Creswell, Plano Clark, & Clarke, 2018).

Data collection was conducted in two sequential phases, beginning with a quantitative phase that aimed at identifying patterns and measurable outcomes related to the use of the tools. This was followed by a qualitative phase, which sought to provide deeper insight and explanation of the quantitative results. This explanatory sequential design allowed for a more nuanced understanding of the data and strengthened the validity of the study's conclusions (Creswell & Plano Clark, 2018).

Sample

In the 2023-24 academic year, the PSP's Cluster Project engaged with 376 Foundation Phase teachers (Grades R–3), reaching approximately 10 791 learners across 27 primary schools in the Western Cape, see diagram 1 for a summary of 2023 project totals.

Foundation Phase Mathematics Cluster Project

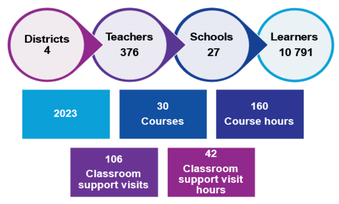


Diagram 1: 2023 Cluster Project reach

The participating schools were grouped based on geographical location and language of learning and teaching (LoLT). The urban schools, located in the Metro East, North and South districts received training and support in English and isiXhosa, and the schools in the semi-rural Overberg Education District (OED) were supported in Afrikaans.

Data Collection

This study examines the range of tools and documentation used in the PSP's Cluster Project to monitor outcomes over a two-year period. The tools tracked teachers' PD and evaluated the project's impact on learners' mathematics achievement. An analytical framework guided the review of the various tools and data collected.

Table 1 summarises the data collection instruments, outlining their specific purposes and corresponding analysis approaches. These tools were central to monitoring and evaluating both workshop training and in-school support. The data provided valuable insights, and enabled facilitators to reflect critically on teacher learning and instructional practices. These insights also informed evidence-based reports for the Cluster Project's funders and the relevant education districts.

Table 1: Overview of tools, their purpose and the analysis approach

Tool	Purpose	Approach to analysis
Needs analysis and teacher survey	To inform facilitators in aligning training and support with school context and teachers' PD needs.	Qualitative and Quantitative
Learner book analysis	To assess the: 1. Curriculum coverage 2. Concept progression 3. Differentiation strategies 4. Assessment practices 5. Feedback to learners 6. Intervention for learner challenges	Qualitative
Attendance registers	To monitor teacher attendance at training sessions.	Quantitative
Learner baseline and endline assessments	To measure learners' progress and determine the project's impact.	Quantitative and Qualitative
Teacher evaluation forms	To assess teacher learning during workshops.	Quantitative and Qualitative
Pre- and post- teacher questionnaires	To evaluate improvements in teachers' mathematical knowledge and understanding.	Quantitative
Classroom observation schedules	To monitor classroom implementation of teaching, learning, and assessment strategies.	Qualitative
Photographic evidence	To document visual records of teacher and learner participation and activities.	Qualitative
Systemic assessment results	To identify gaps in learners' understanding and challenges teachers face in specific concepts.	Quantitative
Stories of change	To capture individual teacher experiences and significant personal or professional development.	Qualitative
Termly reports	To provide feedback on teacher learning and strategy implementation.	Quantitative and Qualitative
Termly meetings with facilitators and district officials	To review implementation progress, identify key challenges in mathematics instruction, and inform planning for subsequent workshops.	Quantitative and Qualitative

Overview of PSP's Foundation Phase Mathematics Cluster Project

The Primary Science Programme (PSP), a registered non-profit organisation with a long-standing commitment to supporting primary school teachers in South Africa, implemented a professional development (PD) programme for Foundation Phase mathematics teachers in 27 primary schools across four districts in the Western Cape over two-years.

PSP focuses on under-resourced schools where teaching and learning conditions are challenging. Its work spans key subjects, including Language & Literacy, Mathematics, Natural Sciences & Technology, Social Sciences, and Environmental Education.

The PSP's Cluster Project offers a comprehensive support model that combines training workshops, classroom coaching, in-class support, and resources. The programme aims to strengthen teachers' mathematical content knowledge and instructional skills. Workshops focused on deepening understanding of mathematics, guiding effective curriculum implementation, and improving assessment practices. Classroom support included team-teaching, coaching, and the provision of practical teaching materials, all helping teachers apply new and innovative strategies within their specific contexts.

The PSP's approach to mathematics instruction is grounded in constructivist principles, closely aligned with the Curriculum and Assessment Policy Statement (CAPS) (DBE, 2011). These principles are consistently reflected in all teacher engagements and embedded throughout the Cluster Project's curriculum.

All training and support sessions are interactive and hands-on, immersing teachers in the same active learning strategies they are encouraged to use with learners. Four-hour workshops were conducted at the beginning of each school term for Foundation Phase teachers (Grades R–3). These sessions improved teachers' lesson planning, curriculum understanding, subject knowledge, and assessment strategies.

Support continued in classrooms through lesson demonstrations, observations, co-teaching, and the use of customised materials. For demonstrations facilitators co-planned with teachers, delivered the lessons or observed teachers, followed by feedback and reflection sessions. Observations allowed facilitators to assess how well teachers translated training into practice. Each teacher also received a set of tailored resource packs and mathematics kits to support ongoing instruction.

Data Analysis

This study employed a mixed-method embedded design to evaluate the effectiveness of the tools used to monitor teacher professional development (PD). Both quantitative and qualitative data analysis methods were used to generate rich, triangulated findings (Creswell, 1998).

Table 2: Analytical framework for tool/document analysis

(Indicators are expanded in paper)

Domain	Key Criteria	Indicators / Guiding Questions	Rating	Notes/Evidence
Purpose Alignment	Clearly aligned with PD goals and teaching standards	- Is there alignment with institutional / national frameworks?		
Content Validity	Captures the full scope of teacher development	- Are various competency areas covered (e.g., pedagogy, content knowledge, leadership)?		
Usability & Accessibility	Practical for real-world use	- Is the tool easy to navigate? - Is it adaptable to different teaching contexts?		
Data Quality	Generates meaningful, trackable data	- Does it collect both qualitative and quantitative data?		
Feedback & Reflection	Supports feedback cycles and teacher self-reflection	- Does it support action planning or goal setting?		
Impact Measurement	Demonstrates influence on practice or learning outcomes	- Is there a mechanism to link data to classroom practice or children's learning?		
Equity & Inclusivity	Adaptable to different contexts and inclusive of teacher diversity	- Is the tool usable across school types, roles, or cultural settings? - Are voices of diverse teachers visible in its use or design?		

Quantitative data collected through various tools were analysed and results interpreted in relation to the study's objectives. The findings were then integrated with qualitative, verbatim descriptive data, which were thematically coded to structure and report key outcomes. The thematic analysis provided deeper insights into the nature and impact of the teacher PD activities.

Analysis of Tracking and Reflection Tools

This section features the feedback and analysis of the tools and documents used in the Cluster Project. The findings are based on the interpretation of data collected and are organised into subsections:

1. Analysis of information-gathering tools and documents
2. Analysis of tools/documents used for tracking teacher professional development and mathematics instruction
3. Analysis of tools/documents used for assessing the impact of mathematics teaching on learner outcomes
4. Analysis of tools/documents used for feedback, reporting, and reflection

The Analytical Framework at Table 2 was used to evaluate each tool/document employed in the Cluster Project, and focussed on assessing the: purpose, content validity, usability, data quality, feedback and reflection mechanisms and impact measurement.

Discussion

Preliminary findings suggest that the tools used in the project were effective in capturing meaningful shifts in teaching practice and learner outcomes. In particular, the data reflected instances where teachers observed increased learner interest, participation, and improved results after implementing practical methodologies. These observations, recorded through various monitoring and reflection tools, indicate that the instruments were successful in documenting both the impact of PD and the uptake of new instructional approaches.

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