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From compliance to agency: Leveraging mixed reality simulation to bridge the enactment gap in initial teacher education

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Background: Although South Africa's primary teacher education knowledge and practice standards establish clear literacy guidelines, an 'enactment gap' remains in initial teacher education (ITE). Components like oral reading fluency assessment and data-based instructional decision-making are often inadequately addressed, leaving pre-service teachers (PSTs) under-prepared to bridge theoretical knowledge and classroom application.

Objectives: This study first audits the extent to which Foundation Phase Bachelor of Education (BEd) language modules represent these standards, moving beyond superficial mention to provide authentic practice-based approximations. Second, it investigates how an integrated module, featuring a practice-based learning cycle facilitated by mixed reality simulation (MRS), enables PSTs to move beyond procedural compliance toward data-based instructional decision-making.

Method: Adopting a descriptive, instrumental case study design, this research unfolded in two phases. Phase one audited BEd language modules at a North West Province university using innovation configuration (IC) mapping. Phase two used purposive sampling to select a module integrating practice-based elements within a learning cycle facilitated by MRS. Data were gathered through IC mapping, video-recorded MRS sessions, and after-action review discussions, analysed via IC rating and a hybrid thematic analysis.

Results: The audit revealed that the enactment failures stem from missed opportunities rather than a lack of will, with modules often prioritising theory over practice-based reasoning. Conversely, the MRS-facilitated action learning cycle enabled PSTs to navigate a trajectory from procedural compliance to active diagnostic reasoning and collaborative sense-making.

Conclusion: While a practice-based learning cycle facilitated by MRS provides a vital environment for rehearsal and reflection, the transition to responsive decision-making is not instantaneous, requiring sustained, scaffolded support.

Contribution: This study offers an empirically grounded framework illustrating how integrating MRS with structured learning cycles can facilitate a shift in ITE from standard representation toward the development of diagnostic acuity and instructional agility in PSTs.

Keywords: reading fluency assessment; data-based instructional decision-making; initial teacher education; PrimTEd standards; mixed reality simulation; practice-based teacher education.

Introduction

Improving early grade reading outcomes remains a national priority in South Africa, with national and international assessments consistently indicating that many learners do not develop adequate foundational reading skills in the early grades (Department of Basic Education 2023; 2024; 2025). These outcomes have intensified scrutiny of how effectively initial teacher education (ITE) programmes prepare pre-service teachers (PSTs) to enact evidence-based, responsive reading instruction (Nel 2022; Spaull 2023; Taylor & Mawoyo 2022). The primary teacher education (PrimTEd) knowledge and practice standards provide a coherent framework for articulating what PSTs should know and be able to do in relation to language and literacy teaching including the integration of assessment into instructional design and the use of assessment evidence to support learner progress (Primary Teacher Education Project 2020).

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The study engages selectively with this framework, focusing on standards related to oral reading fluency (ORF) assessment and data-based instructional decision-making. These standards emphasise that teachers should plan instruction that incorporates phase-appropriate assessment, gather sufficient evidence of learner performance, and use that evidence to guide instructional decision-making (Primary Teacher Education Project 2020). In this sense, assessment is positioned not as an endpoint but as a continuous process through which teaching is adapted in response to learners' strengths and needs.

While the formulation of explicit standards represents an important step towards strengthening coherence in ITE, standards alone do not ensure changes in instructional practice (Shaukat & Chowhury 2020). Implementing these reforms is often hampered by 'siloed' curriculum structures, where theoretical knowledge is disconnected from the realities of practice (Zeichner 2010). Research on professional standards cautions that, without shared interpretation and structured opportunities for enactment, they risk remaining abstract or being used in a compliant fashion by teacher educators (Bourke, Ryna & Ould 2018; Taylor & Robinson 2016). Spillane, Reiser and Reimer (2002) argue that implementation challenges are rarely a failure of educator will, but rather a failure of opportunity, specifically an absence of structured environments that allow for the 'cognitive sense-making' required to translate standards into action. Teacher educators interpret standards through existing schemas, often assimilating novel reforms into established routines rather than fundamentally restructuring their practice. This is especially true for PSTs, who, while in the early stages of building their pedagogical knowledge, may inadvertently believe they are adopting new approaches while effectively reproducing traditional instructional practices. This gap is particularly evident in literacy education, where quality instruction depends on the ability to integrate knowledge and practice in real time, respond diagnostically to learner performance, and enact instructional routines with fidelity (Tortorelli, Lupo & Wheatley 2021).

In this study, ORF assessment and data-based instructional decision-making serve as a focal practice through which these challenges can be examined. Oral reading fluency assessment, which typically involves assessing accuracy, rate, and prosody during oral reading (Pikulski & Chard 2005; Van der Velde et al. 2024), provides insight into learners' reading development and can inform decisions about instruction and support. When used formatively, such assessment enables teachers to identify patterns in learner performance, monitor progress, and adjust instruction accordingly. However, enacting ORF assessment as a data-informed practice requires more than conceptual knowledge; it requires the ability to administer assessments with fidelity, record learner responses systematically, and interpret assessment evidence in relation to instructional decision-making (Good et al. 2011).

Despite the recognised value of ORF assessment as a formative practice, research indicates that PSTs often have limited opportunities to enact assessment in ways that integrate administration, interpretation, and instructional response (Nel 2011). Within ITE, assessment is often addressed at a conceptual level, with less emphasis on the procedural and interpretive dimensions required to generate, analyse, and use assessment evidence to inform instruction (Oo, Alonzo & Asih 2022). As a result, PSTs may demonstrate knowledge of assessment principles without being able to apply them consistently in practice or use assessment evidence to inform instructional decisions.

Addressing this enactment gap requires pedagogical approaches that move beyond the representation of practice in coursework toward approximations of practice (Grossman et al. 2009a; Schutz, Danielson & Cohen 2019). This study emphasises that the efficacy of these approximations depends on the support provided within a practice-based learning cycle, which Kelley-Petersen et al. (2018) frame as the 'into, through, and beyond' approach. In this cycle, support is systematically structured: 'into' enactment, through representations such as video analysis and modelling; 'through' enactment, by leveraging mixed reality simulation (MRS) practice alongside structured observation tools (Schutz et al. 2019); and 'beyond' enactment, through after-action review (AAR), professional conversations and directive coaching (Cohen et al. 2020) that facilitate evidence-informed feedback, reflection, and the development of diagnostic reasoning.

By examining how these practice-based opportunities are structured within language modules within a Bachelor of Education (BEd; Foundation Phase) programme at a selected university in North West Province, this study examines the extent to which evidence-based reading practices and selected PrimTEd standards are represented within the modules, and investigates the potential for a practice-based learning cycle, facilitated by MRS, to bridge the enactment gap. By analysing the transition from theoretical 'mentions' to enacted approximations, the study addresses the following research questions:

- To what extent are ORF assessment and data-based instructional decision-making aligned with relevant PrimTEd standards and evidence-based reading practices, represented in selected language modules?
- To what extent does the practice-based learning cycle, facilitated by MRS, enable PSTs to bridge the gap between procedural assessment administration and responsive data-based instructional decision-making?

Literature review

Practice-based teacher education: A theoretical framework

The central challenge of ITE lies in what Kennedy (1999) terms the enactment gap. This gap represents the persistent

disconnect between the conceptual knowledge of reading literacy that PSTs acquire and their ability to translate that knowledge into responsive classroom practice (Nel & Marais 2023). Research conducted by Tsakeni et al. (2026) indicates that, while PSTs often possess the intention to implement evidence-based practices, they frequently face structural and contextual barriers that prevent successful execution during the teaching practicum.

Practice-based teacher education (PBTE) has emerged as a prominent framework for addressing this disconnect. It shifts the focus of teacher learning from the acquisition of abstract theoretical knowledge to the performance of 'core' or 'high-leverage' teaching practices (Grossman & Fraefel 2024; Grossman, Hammerness & McDonald 2009b). Practice-based teacher education posits that teaching consists of skills that can be decomposed, practised, and refined. A central element is the use of approximations of practice: pedagogical tasks that enable PSTs to rehearse complex routines in reduced-complexity settings (Howell & Mikeska 2021; Schutz et al. 2019).

In the South African context, this shift is critical. Taylor and Robinson (2016) argue that the current ITE system remains isolated from the realities of the schooling cycle, resulting in a professional curriculum that lacks the diagnostic rigour required to disrupt systemic underperformance. To bridge this gap, ITE programmes must move beyond superficial representations of standards. The efficacy of this transition can be facilitated by the practice-based learning cycle framed by Kelley-Petersen et al. (2018) as the 'into, through, and beyond' approach. This cycle provides a structured move from theoretical representations (into) to high-leverage rehearsal within MRS (through), and finally to AAR and diagnostic reasoning (beyond) (Cohen, Yonas & Wilson 2025). The application of this structured rehearsal is particularly important in the domain of ORF assessment, where technical fidelity must be paired with data-based instructional decision-making.

Oral reading fluency assessment and data-informed instructional decision-making

Within the science of reading, ORF is recognised as a vital bridge between foundational word-level decoding and the cognitive resources required for deep text comprehension (Hudson, Lane & Pullen 2005). The inability to decode with automaticity forces a learner to expend excessive cognitive energy on word recognition, making meaning construction difficult, if not impossible (Hudson et al. 2005). Given this, the systematic assessment of ORF is not merely a monitoring tool, but it is a diagnostic imperative that should be regularly applied in the early years of schooling (UNESCO Institute for Statistics 2016).

However, the efficacy of ORF assessment is entirely dependent on the teacher's ability to engage in data-informed instructional decision-making. As argued by Nel (2018), making decisions about reading instruction is as core a component of teaching as the instruction itself. The International Literacy Association (ILA 2018) emphasises that assessment data should not be used merely for administrative compliance but should be treated as a 'portrait' of learners' learning, a 'highlighter' of specific instructional needs, and a 'springboard' for targeted instructional intensification.

When teachers move toward fine-grained error analysis, they gain the capacity to identify whether a learner's fluency struggle stems from phonemic, orthographic, or morphemic deficits (Toste et al. 2025). This diagnostic process allows for the implementation of differentiated and responsive instructional support.

However, a significant bottleneck in teacher preparation is that, while PSTs may understand the concept of ORF, they often lack the procedural proficiency to administer these assessments with fidelity and interpret the results to drive instructional change (Nel 2018; Uebele 2025). Without structured opportunities to apply data-informed instructional decision-making in supported environments, PSTs risk 'mapping new labels onto old habits', where they collect data without fundamentally changing their instructional response to the learner (Spillane et al. 2002).

Mixed reality simulation as an approximation of practice

To bridge the persistent enactment gap between pedagogical theory and the complexities of classroom application, ITE programmes are increasingly turning to MRS as a scaffolded 'approximation of practice'. Cohen et al. (2025) define these approximations as reduced-complexity settings which provide PSTs with supported opportunities to rehearse instructional routines without the unpredictability or risk inherent in authentic classroom settings. By allowing PSTs to 'learn to kayak on calm waters' (Grossman et al. 2009a:2076), MRS environments, which involve a human simulation specialist operating virtual avatar learners, provide a safe and protected space to practise core literacy routines (Allen & Stecker 2023; Whitney & Ackerman 2026).

The empirical literature on MRS highlights its potential as a pedagogical environment rather than just a technical tool. Dalinger et al. (2020) found that MRS-based 'strategic practice' leads to increased teacher confidence when transitioning to authentic field experiences (i.e. teaching practicum). Similarly, Aguilar and Flores (2022) demonstrated that PSTs using MRS showed improvements in complex instructional skills, such as questioning and eliciting learner thoughts, compared to a control group without simulation access.

Crucially, the efficacy of MRS is not determined by the technology itself but by how it is strategically embedded within a practice-based learning cycle. Building upon the 'into, through, and beyond' framework (Cohen et al. 2025; Kelley-Petersen et al. 2018), this cyclical approach integrates targeted coaching (Cohen et al. 2020) and deliberate practice (Ericsson & Pool 2016). When MRS is paired with

differentiated feedback, PSTs significantly increase their use of 'high information' feedback (Bondie et al. 2023). This aligns with the theory of deliberate practice, which posits that novices improve most when they receive immediate, iterative feedback within their zone of proximal development (Cohen et al. 2025; Ericsson & Pool 2016). By requiring PSTs to pause, reflect, and adjust their pedagogical strategy, the simulation environment remains demanding and growth-oriented, successfully transforming the approximation into a catalyst for professional diagnostic acuity.

Research methods and design

Research design

Utilising a descriptive, instrumental case study design (Stake 2005; Yin 2018), this study examines the representation of ORF assessment and data-based instructional decision-making within selected language modules in a BEd (Foundation Phase) programme, while simultaneously investigating how a practice-based learning cycle embedded in a MRS enables PSTs to bridge the enactment gap between assessment implementation and instructional decision-making. Miles, Huberman and Saldana (2014:28) state that a case study is 'a phenomenon of some sort in a bounded context'. This case study is defined by an institutional (a selected university in North West Province, South Africa), programme (BEd with a specialisation in Foundation Phase teaching, Grade R to Grade 3) and module boundary (language modules in Afrikaans, English, SeTswana, SeSotho, isiXhosa and isiZulu). This is an instrumental case in that the case itself (i.e. language modules) is examined to provide insights into the broader issue of an enactment gap, related to ORF assessment and data-based instructional decision-making, rather than for the case's own sake.

Participants and participant selection

All teacher educators (N = 12, six permanent and six temporary) responsible for teaching language modules in the BEd Foundation Phase programme were purposefully selected to participate in the study. The permanently employed language teacher educators all attended a 'mapping' session as part of an internal programme evaluation in preparation for the forthcoming Council for Higher Education review of the BEd programmes in South Africa. The mapping process entailed analysing all the language modules (Afrikaans, English, SeTswana, SeSotho, isiXhosa and isiZulu), offered within the Foundation Phase programme, utilising an innovation configuration (IC) (cf. Appendix 1). For the purpose of this study, the six modules (i.e. each language) that address ORF assessment and data-based instructional decision-making in the third year of the BEd programme were included. Based on the analysis of the language modules during phase 1 of the study, the language module with the highest implementation score (i.e. an average of four on all components of the IC) was purposefully selected for inclusion during phase 2 of the study. One mentor teacher that usually fulfils the role of mentor teacher to PSTs at a primary school in North West Province during school-based teaching practicum volunteered to be part of the MRS sessions to ensure that all stakeholders (i.e. teacher educators, PSTs and mentor teacher) could provide input during phase 2. In addition, 129 third-year PSTs, enrolled for the language module with the highest implementation score in the BEd (Foundation Phase) programme, also participated in the study.

Researcher positionality and trustworthiness

In this study, I occupied a complex positionality, serving simultaneously as the researcher, MRS specialist, and co-developer of the data collection tools. This multifaceted role necessitated rigorous reflexive practice to manage the inherent tension between pedagogical advocacy and empirical observation. As Yip (2024) notes, researcher membership status, whether as an insider or an outsider, is an essential, ever-present aspect of qualitative investigation. To mitigate the risk of confirmation bias, I followed the guidance of Dwyer and Buckle (2009) by embracing the 'space between', recognising that my perspective is shaped by my roles, professional knowledge, and interactions with participants.

I enhanced trustworthiness through three mechanisms. First, I engaged an external 'critical friend' (Schuck & Russell 2005), a specialist in language teaching and learning, to audit 50% of the IC coding done by the teacher educators. The 'critical friend' provided input on data collection tools and interpretation to resolve potential subjectivities, ensuring findings were not merely a projection of my own expectations. Second, I maintained a rigid distinction between behavioural enactment data, participant discourse, and my own analytic inferences. This structural separation acknowledged that, while my 'personhood' (Dwyer & Buckle 2009) affects the analysis, the analysis simultaneously informs my developing professional identity. Third, I intentionally prioritised the reporting of disconfirming cases (Booth et al. 2013) to ensure findings reflect the complexities of the language modules rather than an idealised narrative (Yin 2018). By utilising the IC to create an objective audit trail, I ensured that my interpretations remained grounded in evidentiary markers, demonstrating that the findings are contextually situated, authentic, and empirically warranted.

Data generation and procedures

Data generation included two sequential phases: a macro-level self-evaluative audit of the language modules, followed by a micro-level analysis of pedagogical enactment within a MRS environment. The first phase involved a systematic audit of BEd Foundation Phase language modules to determine to what extent ORF assessment and data-based instructional decision-making were represented. An IC (cf. Appendix 1), a diagnostic tool for analysing variations in the enactment of complex practices, was used for this purpose (Hall & Hord 1987; Hord et al. 2013). The IC was developed through a desktop analysis of evidence-based reading

instruction and assessment (Lane 2024) and relevant PrimTEd knowledge and practice standards (Primary Teacher Education Project 2020). By categorising implementation along a continuum from non-use to ideal practice, an IC can reveal both conceptual depth and potential gaps in opportunities for PST rehearsal (National Comprehensive Center for Teacher Quality 2011).

To ensure module ownership and mitigate research bias, this audit was a collaborative professional exercise. Teacher educators assigned implementation codes (0–4) based on their module design and delivery. To ensure reliability, a 'critical friend' (i.e. a language education specialist) and I independently audited 50% of the modules. Initial inter-rater agreement was 85%, and through consensus-building meetings, where we clarified the criteria for code 3 (representations) and code 4 (approximations), we achieved 100% agreement. This verified audit process established an objective baseline for selecting the focal module for phase 2, purposively selected for its code 4 designation, which indicates the integration of practice through deliberate rehearsal.

The second phase examined the situated site of practice where PSTs engaged in ORF assessment and data-based instructional decision-making. Data generation was structured around a four-stage practice-based learning cycle: introduction, before-action review (BAR), enactment, and AAR. A practice-based observation and reasoning tool scaffolded both the PSTs' enactment and the subsequent AAR (cf. Table 1). During the AARs, the tool facilitated situated coaching, grounded in the principles of deliberate practice (Ericsson 2002), focusing on reflective inquiry, coaching, and instructional planning.

In total, 26 MRS sessions (20–30 min each) were conducted with PSTs working in groups of four or five. During the sessions each student had a role: assessment administration, qualitative note-taking, scoring and data-based instructional decision-making. Data generation encompassed the video recordings of the enactments and the recorded coaching, reflection and feedback dialogues, providing a comprehensive audit trail of how PSTs navigated the gap between pedagogical theory and practice.

Data analysis

During the first phase an IC was used to determine to what extent ORF assessment and data-based instructional decision-making are represented in language modules, aligned with relevant PrimTEd standards and evidence-based reading practices. The IC matrix consists of two dimensions: essential components (row headings) and degree of implementation (column headings, 0–4). The structure is hierarchical, where an increase in score represents greater complexity in the implementation of the core practice (Hall & Hord 1987).

TABLE 1: Oral reading fluency assessment and instructional decision-making observation and reasoning tool.

What is observed? (Enactment)	What does it mean? (Interpretation)	What next? (Instructional decision-making)
Assessment administration		
• Standardised administration: environment, clarity of instructions, neutral tone, rapport, timekeeping, adherence to ORF procedures • No instructional interference during assessment • Ethical and supportive practice (e.g. stop assessment if learner is distressed, avoid negative feedback)	How did administration choices influence learner performance and validity of the data? Were there any factors that may have distorted the reading sample?	What adjustments are needed to improve administration fidelity in future assessments?
ORF accuracy		
• Types of errors (substitutions, omissions, insertions, reversals)	What error patterns are evident? What do these errors suggest about the learner's decoding strategies or gaps (e.g. phonics patterns, orthographic knowledge)?	What is the specific instructional focus based on the identified pattern (e.g. vowel teams, blends, multisyllabic decoding)?
Rate and fluency		
• Words correct per minute, pacing, hesitations, automaticity	Does the rate reflect automatic word recognition or effortful decoding? How does fluency impact comprehension?	What type of fluency support is needed (e.g. phrase fluency or phrase-cue reading, repeated reading)
Prosody and reading behaviours		
• Expression, phrasing, intonation, attention to punctuation, self-corrections	What does the learner's prosody indicate about comprehension and engagement? Are there any signs of monitoring or breakdown in meaning-making?	How can instruction support expressive and meaningful reading (e.g. modelling phrasing, echo reading)?
Recording and data accuracy		
• Alignment between observed reading and recorded data • Calculates words correct per minute accurately • Records raw data (total words read + errors) • Notes qualitative responses separately from score	How reliable is the recorded data? Are there discrepancies between performance and recording? What might explain these?	What practices are needed to improve accuracy and reliability of data collection?
Learner profile		
• Words correct per minute linked to benchmark, notes synthesising learners' strengths and weaknesses	Based on the data, what is the learner's reading profile (e.g. strong sight word recognition but weak decoding of vowel patterns)?	What is the priority area for instruction for this learner?
Linking assessment to instruction (after-action review)		
	How effectively does the PST (group) interpret assessment data to inform instructional decisions? What reasoning is evident?	What specific, targeted instructional response is planned based on the data?

Note: The tool was designed as a practice-based scaffold to support PSTs in navigating the enactment gap.
ORF, oral reading fluency; PST, pre-service teacher.

To maintain analytical consistency, the scoring followed these systematic steps:

- **Step 1 – Component mapping:** After a thorough module review, the teacher educator for each module assigned a specific implementation code to each component descriptor, reflecting their explicit knowledge of the module's design and delivery.
- **Step 2 – Item rating:** Each descriptor was assigned an overall rating based on the highest level of implementation achieved by the module.
- **Step 3 – Ordinal interpretation:** The ratings were treated as ordinal data. While a score of 4 indicates more thorough implementation than a score of 2, these intervals are not mathematically equidistant and thus do not represent a linear ratio.
- **Step 4 – Gap identification:** Finally, the results were used to map similarities, differences, and module gaps, providing the basis for identifying the focal module for phase 2.

For the second phase, the analysis focused on determining whether PSTs successfully moved beyond a purely 'procedural' focus on assessment administration toward a 'pedagogical focus on diagnostic reasoning'. To this end, a hybrid thematic approach was used to analyse the data (Fereday & Muir-Cochrane 2006). This process employed deductive codes derived from the practice-based observation and reasoning tool (cf. Table 1) to capture expected pedagogical competences, alongside inductive codes to identify emergent reasoning patterns such as 'procedural fixation'. This dual coding process ensures a visible audit trail from raw video and transcript data to analytic claims. By integrating these patterns into a final matrix, observed errors in the simulator were linked to the PSTs' planned interventions, providing a direct audit trail from the simulation data to claims regarding PSTs' development. To maintain analytical transparency, PST discourse and performance during the MRS enactment and AAR sessions were categorised according to the schema presented in Table 2.

Ethical considerations

Ethical clearance for this study was obtained from the North-West University Education, Management and Economic Sciences, Law, Theology, Engineering and Natural Sciences Research Ethics Committee (NWU-EMELTEN-REC) on 16 May 2023. The ethical clearance number is NWU-00403-23-A2. The gatekeeper committee of the participating university also provided ethical clearance. All participants provided written informed consent before taking part in the mapping process and the MRS sessions.

Results and discussion

This section integrates the findings from the macro-level audit of the language modules and the micro-level analysis of the enactment within the MRS environment, presenting them sequentially through the study's research questions to highlight the developmental trajectories of the PSTs.

Macro-level audit of language modules

The analysis of the language modules, using the IC, revealed one recurring theme, namely 'theoretical abstraction'. While the module content and teaching and learning materials demonstrate alignment with conceptual standards, there is a marked discrepancy between the focus on theoretical knowledge and the design of structured opportunities for enactment.

Table 3 illustrates that, except for module C, which achieved a code 4 across all components, the remaining modules demonstrate limited evidence of practice-based learning. The data indicates that the enactment gap is reinforced by a lack of structured opportunities to perform the work of teaching. The average implementation rating of 1.75 for modules A, B, D and E reflects a module

TABLE 2: Coding schema and audit trail.

Deductive code (observation and reasoning tool)	Inductive code (emergent pattern)	Description	Example from transcript
Assessment administration	Compliance barrier	PST focuses on stopwatch or protocol over learner needs	'I was so worried about the 60 seconds I didn't see the learner pause.'
ORF accuracy	Professional noticing	PST identifies specific patterns and links them to underlying knowledge deficits	'The learner substituted the vowel teams consistently; it's a decoding gap, not just a guess.'
Rate and fluency	Fluency-comprehension link	PST connects automaticity to meaning-making	'Because they spent too long on each word, they couldn't retell the story.'
Prosody and reading behaviours	Supportive noticing	PST identifies engagement or prosody as comprehension indicators	'The learner read without expression, suggesting they didn't pay attention to punctuation.'
Recording and data accuracy	Procedural fixation	PST struggles to balance scoring while observing	'I missed the last three words because I was still recoding the error.'
Learner profile	Synthesis struggle	PST struggles to turn data into a coherent narrative	'I have the numbers, but I'm not sure how to describe the learner's needs.'
Linking assessment to instruction	Coaching-mediated insight	PST proposes targeted instructional intervention	'After discussing the vowel errors, I'll plan a mini-lesson on long /a/ teams.'

ORF, oral reading fluency; PST, pre-service teacher.

TABLE 3: Innovation configuration summary of language modules.

Essential components	Module A	Module B	Module C	Module D	Module E	Module F
Conceptual and assessment knowledge	3	3	4	3	3	3
Administering, scoring and recording	2	2	4	2	2	2
Profiling and data interpretation	2	2	4	2	2	2
Data-informed instructional decision-making	0	0	4	0	0	1

design that prioritises theoretical constructs over pedagogical diagnostic reasoning. For example, module D's lecture slides state: 'The primary goal of ORF is to reach the benchmark WCPM for the grade level.' This emphasis on benchmark attainment, with the absence of guidance on diagnostic interpretation, encourages what Cohen et al. (2025) describe as the assimilation of novel reforms into established, performative routines.

Furthermore, the audit identifies a critical deficit in data-informed instructional decision-making. Modules A, B, D, and E received a rating of 0, indicating that the teaching and learning materials do not specify how assessment evidence should inform pedagogical adaptation. However, module C provides explicit directives*:* 'using your recorded quantitative data (i.e. the WCPM) and your qualitative error analysis, justify your selection of one decoding intervention for your next lesson plan' (Module C, MRS portfolio). This supports the argument by Spillane et al. (2002) that implementation challenges arise from cognitive sense-making (i.e. without explicit directives to link evidence to action, PSTs remain focused on the collection of data rather than its pedagogical application). As Grossman et al. (2009a) argue, ITE programmes must transition from providing representations of practice to facilitating approximations of practice. The current audit seems to indicate that where enactment is not explicitly scaffolded in course materials or practice-based opportunities, PSTs are left to navigate the enactment gap without guidance, leaving evidence-based reading practices and PrimTEd standards, related to ORF assessment and data-informed instructional decision-making, pedagogically inert.

Micro-level analysis of selected language module

To examine the PSTs' developmental trajectory, this analysis maps the evidence against the 'into, through and beyond' framework (Kelley-Petersen et al. 2018), which mirrors the four-stage action learning cycle employed: introduction, BAR, enactment, and AAR. While the framework provides a structured lens to interpret the progression, three themes emerged inductively from the data: the compliance-procedural barrier, the diagnostic shift, and the synthesis challenge. Throughout the analysis, disconfirming cases were purposefully included to ensure that the findings reflect the complexities of the PST experience rather than a linear progression.

The compliance-procedural barrier: The 'into' phase

The 'into' phase comprised the introduction (i.e. video analysis) and the BAR, where the cognitive focus was on theoretical preparation (i.e. the how and why of ORF assessment). The data indicated that PSTs encounter a compliance barrier where the primary concern is mastering the technical assessment protocol. This tendency toward procedural fixation highlights a tension between compliance and competence. By prioritising the instrumental compliance of time and scoring over the pedagogical reasoning, PSTs struggled to transition from a teacher-as-technician role to a teacher-as-clinical role. This is consistent with cognitive load theory (Sweller 1988), which suggests that for novices, the extraneous load of learning a new procedural system can exhaust the working memory, leaving little capacity for meaningful pedagogical observation. As one group commented: 'It seemed like the process was just about following the sequence correctly' (PST Group 3, BAR transcript). Another group commented: 'I didn't realise that saying "well done" during the test would make the learner stop and look at me … it messed up the one-minute timing' (PST Group 12). The teacher educator commented:

> 'In our preparation session, we are focused on ensuring you understand the scoring criteria so that the technical administration is second nature before you even step into the simulation classroom.' (Teacher educator, BAR coaching, female)

A disconfirming case emerged in group 4 where the PSTs utilised the introduction videos to develop a 'pre-performance' mental map that seemed to bypass procedural fixation.The transcript of their BAR discussion suggests a shift from 'how do I do this?' to 'what will I see, and how will I react?' The comment they made was:

> '[*W*]atching the video, I noticed how the learner hesitated at the consonant blends. If we see that happen in our classroom session, we need to focus on whether it's a decoding issue or just a lack of confidence. Let's make sure we have our observation tool ready to make notes on those types of errors.' (PST Group 4, BAR transcript, females)

This shift toward anticipation suggests that rigorous engagement with representations of practice (Grossman et al. 2009b) can serve as an essential cognitive scaffold, allowing PSTs to anticipate the demands of enactment before they are immersed in the MRS environment.

The diagnostic shift: The 'through' phase

The 'through' phase is defined by the enactment stage within the MRS. This theme identifies the 'diagnostic shift', the moment of professional noticing, as an emergent capability during the act of teaching. This transition is framed by Van Es and Sherin (2002), who posit that learning to notice, involves a fundamental shift in how teachers 'see' the classroom (i.e. moving from a descriptive account of events to an analytical interpretation of the substance of learner thinking). The data indicates that when PSTs move from merely 'checking' the protocol to actively 'attending to' the specific decoding patterns of the learner, they begin to bridge the enactment gap.

For example, one PST commented that:

> 'When I was in the middle of the assessment, I realised that the learner wasn't just guessing, but he was consistently confusing the short /ĭ/ sound like in the word rid with long vowel /ī/ silent e, like in the word ride.' (PST Group 3, females)

During the coaching session, the teacher educator commented:

> 'You are identifying the decoding gap in real-time. That focus on the specific error pattern is what we mean by professional noticing. I don't want you to tell me that it is just a decoding problem; you need to be specific, as you were, to ensure that your instruction can be adapted to address that specific issue.' (Teacher educator, MRS session, female)

The mentor teacher commented on a realisation about her own practice:

> 'I realise that by doing the assessments without using the same instructions and procedure for the children, I was actually doing them a disservice. I may have incorrectly identified problem areas. I don't think I have ever paid attention to their prosody.' (Mentor teacher, session 14, female)

Notably, not all PST groups achieved this shift. A disconfirming case in Group 17 persisted in labelling errors as 'careless' and 'reading too slow' rather than identifying decoding patterns during the enactment. This highlights that the 'through' phase demands a high-level practice-based focus that, as Ball and Forzani (2009) argue, requires structured opportunities to practise 'high-leverage' instructional activities. Van Es and Sherin (2002) suggest that this ability to notice is not an innate talent but a learned practice that must be explicitly coached, as seen in the variance between groups who were able to move past description and those who remained focused on the surface-level mechanics of assessment.

The synthesis challenge: The 'beyond' phase

The 'beyond' phase, defined by the AAR, is where PSTs grapple with translating diagnostic observations into targeted pedagogical design. Spillane et al. (2002) contend that implementation challenges are rooted in 'sense-making', the process by which practitioners interpret and apply new knowledge within their existing pedagogical frameworks. The PSTs commented that:

> 'Now that I'm looking at the data we collected, I can see the pattern of struggling with multisyllabic words. The challenge is deciding how to turn that specific observation into a mini-lesson for tomorrow.' (PST Group 11, AAR transcript, females)

> 'In our coursework we learn about ORF assessments, like the EGRA, but I didn't know what it was all about and how to determine what learners were struggling with. … We only have to design lesson plans.' (PST Group 15, AAR transcript, females)

> 'Assessing these learners was difficult. I didn't realise that I had to be looking and doing so many things at the same time, and then having to figure out what the learner's needs are. I also don't know where to start to help them. I can write a test on this, but this is a whole different ball game.' (PST Group 3, AAR transcript, females)

> 'I can now "see" … that the learners are really very different which means that I will have to re-think how best to support these learners. I now know why Ms Thembi [adult avatar] told us that we need a whole toolbox of techniques.' (PST Group 23, AAR transcript)

The teacher educator's feedback and the adult avatar's coaching in the AAR serves as a model of diagnostic reasoning, transforming raw scores into a scaffolded plan:

> 'We have the data from the assessment, and we have determined that you accurately scored the learner and that he is reading below the benchmark set for Grade 2 (English). Now, let's design a 5-minute targeted practice routine that addresses that specific vowel team error.' (Teacher educator, AAR coaching transcript, female)

> 'Let's look beyond the score and focus on what the data is telling us about the learner's reading processing. The oral reading fluency results give us three key indicators: accuracy, rate and prosody. In this case, the accuracy rate suggests that decoding is not yet fully consolidated. When we look more closely at the error patterns, we see substitutions that sometimes change the meaning of the text, which points to a need for more explicit phonics and word recognition instruction. The reading rate is below the expected benchmark, indicating that the learner is still allocating significant cognitive effort to word identification. In addition, the limited use of prosody, such as lack of phrasing, suggests that the learner is not yet reading in a way that supports meaning-making. Based on this evidence, our instructional decisions should prioritise targeted support in small groups. I would recommend explicit phoneme-grapheme mapping and high frequency word practice to strengthen accuracy, combined with repeated and guided oral reading to build rate and prosodic reading. Modelling fluent reading and providing opportunities for echo and choral reading can also support the development of expression and phrasing.' (Adult avatar, AAR transcript, female)

While the majority struggled, a disconfirming case in Group 5 demonstrated an intuitive leap, immediately knowing how to design an intervention during the AAR without prompting or coaching. These exceptions seem to highlight that the transition from noticing to instructional decision-making is contingent on the PSTs' existing content knowledge and pedagogical content knowledge. Ultimately, the variation in how PSTs navigated this challenge demonstrates that the enactment gap is not merely a failure of procedural knowledge, but a complex challenge of pedagogical sense-making that requires the iterative, scaffolded environment that only deliberate practice, facilitated by MRS, can provide.

Conclusion

The enactment gap within ITE is not a failure of will, but a failure of opportunity, specifically an absence of structured opportunities that bridge the distance between theoretical knowledge and practical expertise. The findings, derived from both the language module audit and the micro-level analysis of the action learning cycle, reveal that bridging this gap requires more than module reform; it demands a fundamental shift in how we structure pedagogical enactment.

The audit process revealed that within the sampled language modules, there was a frequent misalignment

regarding the enactment of evidence-based reading practices and standards, as the modules often functioned as silos that prioritised technical compliance over the development of pedagogical reasoning. Within this context, MRS emerges as a vital, practice-based pedagogical tool. By providing a controlled, low-complexity environment, MRS enables PSTs to move beyond procedural fixation, where assessment protocols are seen merely as tasks to be completed, to a state of disciplined professional noticing. The alignment between the MRS environment and the action learning cycle allows PSTs to master the technical demands of ORF assessment while simultaneously developing the judgement necessary for data-based instructional decision-making.

As the PSTs moved from the 'into' phase of preparation, 'through' the enactment of ORF assessment, and finally, into the 'beyond' phase of shared sense-making, they were afforded the opportunity to develop professional vision. This process highlights that when PSTs are supported by directed coaching, representations of practice, feedback, and structured observation tools, they can move beyond template compliance to bridge the enactment gap.

The limitations of this study include the reliance on a single cycle of action learning, which may constrain the observation of long-term development in professional noticing, and the fact that findings are specific to the participants within this particular MRS context.

Nevertheless, these results have implications for the broader landscape of teacher education. For ITE programmes seeking to move beyond superficial compliance, the operationalisation of practice-based learning cycles within an MRS environment may not be a luxury but a necessity to ensure that PSTs move from rote implementation to diagnostic agility. Syllabi should adopt an architecture that embeds representations, enactment, and reflection and coaching, utilising tools like MRS as non-negotiable components of every practice-based language module. By institutionalising these spaces, ITE providers can ensure that the next generation of educators does not merely learn about reading instruction and assessment, but develops the professional responsiveness and instructional agility required to respond to the nuanced realities of the literacy classroom, thereby potentially disrupting the systemic cycle of reading underperformance.

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CRediT authorship contribution

Carisma Nel: Conceptualisation, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Validation, Visualisation, Writing – original draft, Writing – review & editing. The author confirms that this work is entirely their own, has reviewed the article, approved the final version for submission and publication, and takes full responsibility for the integrity of its findings.

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Data availability

Data supporting the findings of this study are available from the author, Carisma Nel, on reasonable request, and permission from the university gatekeeper.

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Appendix starts on the next page →

Appendix 1

TABLE 1-A1: Oral reading fluency assessment innovation configuration.

Knowledge and practice standards for primary teacher education graduates: Language and literacy

- Demonstrate knowledge of how to develop fluency in reading through a flexible use of strategies.
- Select and organise content into a coherent, well-sequenced instructional design using knowledge of the curriculum, learners' strengths and weaknesses, and assessment and reporting requirements.
- Demonstrate an understanding of the range of types and multiple purposes of assessment in literacy, including for selection (screening), diagnosis, guidance, grading, prediction, motivation and standard maintaining.

Instructions: Place an X under the appropriate variation implementation score for each module/course that meets the criteria level from 0 to 4. Score and rate each item separately.	**Implementation levels Coursework including representations/approximations/work integrated learning**					
	Code 0	**Code 1**	**Code 2**	**Code 3**	**Code 4**	**Rating**
Conceptual and assessment knowledge						
• Understanding oral reading fluency as the integration of accuracy, rate, and prosody						
• Purpose of ORF assessment (Screening, diagnostic, and progress monitoring)						
• Theoretical relationships: vocabulary, syntax, semantics, comprehension						
• Knowledge of benchmarks (e.g. words correct per minute)						
• Principles of valid, reliable, and standardised assessment						
Administering, scoring and recording						
• Follows standardised instructions and ensures consistent assessment conditions						
• Accurately marks errors in real time (Substitutions, omissions, insertions, reversals)						
• Distinguishes between errors and non-errors (e.g. repetitions, self-corrections)						
• Calculates words correct per minute (WCPM) accurately						
• Records raw scores and error patterns systematically						
• Maintains consistency in scoring procedures across learners						
• Assesses phrasing, expression, and intonation (i.e. prosody)						
• Identifies patterns in reading performance (e.g. hesitations, monotone reading)						
Profiling and data interpretation						
• Interprets ORF data to identify learner strengths and needs						
• Differentiates between challenges related to accuracy, rate, and prosody						
• Analyses error patterns to infer underlying reading difficulties						
• Integrates quantitative (WCPM) and qualitative (prosody, behaviours) data						
Data-informed instructional decision-making						
• Groups learners based on assessment data						
• Selects appropriate instructional responses and fluency interventions (i.e. evidence-based strategies and routines; differentiation)						
• Matches instructional strategies to identified learner needs						
• Adjusts text selection and task difficulty based on data						
• Plans targeted support based on assessment outcomes						

Implementation Code

Instructions: Place an X under the appropriate variation implementation score for each module and component within the module that meets the criteria level from 0 to 4. Score and rate each item separately.

Code 0: There is **no evidence** that the component is included in the module.

Code 1: The module **only mentions** the component (e.g. in the study guide, or PowerPoint slide deck).

Code 2: The module mentions content and includes **at least two** of the following:

Written	Visual/Audio-visual	Practice-based
• Readings (Books/journal articles)	PowerPoint presentations	Demonstration
• Assignments/tests	Videos	Observations
• Portfolios (application)	Podcasts	Modelling
• Transcripts/learner work	Webinars	
• Lesson plans	Online courses	
• Case studies		

Code 3: The module includes content related to the components and must contain **at least three** of the representations **AND** school-based teaching practice.

Code 4: The module mentions content related to the component and must contain **at least four** of the representations (from different categories) **PLUS one** of the following approximations **AND** school-based teaching practice**:**

- Mixed reality simulation
- Microteaching/rehearsals
- Lesson study
- Instructional round

ORF, oral reading fluency; WCPM, word count per minute.