

## Indigenous knowledge systems as a catalyst for inclusive self-directed learning in rural South African secondary schooling: Evidence from a mixed-methods case study

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**Abstract:** South African curriculum policy recognizes indigenous knowledge systems (IKS) and commits schooling to inclusive, socially responsive learning, yet rural schools often struggle to operationalize these aims. This article synthesizes evidence from a convergent mixed-methods single-case study in a rural secondary school in the Alfred Nzo West District (Eastern Cape) to examine how IKS integration relates to inclusive participation and self-directed learning (SDL). Qualitative data (semi-structured interviews with teachers, parents, and community elders; a learner focus group) and quantitative questionnaire indicators were collected concurrently and analyzed using thematic analysis and descriptive statistics, then triangulated. Findings suggest that locally grounded IKS examples increased learner engagement, broadened participation, and supported SDL behaviors, including questioning, goal-setting during inquiry, peer explanation, and reflection. Implementation, however, was constrained by limited teacher professional development, insufficient learning materials and time, and gaps between policy intent and school-level enactment. The article proposes an IKS-enabled implementation pathway to guide systematic integration through community knowledge mapping, curriculum alignment, inclusive lesson design, learner-led inquiry, and iterative assessment. The study argues that IKS can function as an applied pedagogical design strategy for inclusion and learner agency when aligned with coherent professional learning and context-appropriate resources.

**Keywords:** Curriculum implementation, Inclusive education, Indigenous Knowledge Systems (IKS), Rural secondary schools, Self-directed learning (SDL), South Africa.

### 1. Introduction

South African curriculum policy positions schooling as socially transformative and explicitly recognizes the educational value of indigenous knowledge systems (IKS), including the principle of “valuing indigenous knowledge systems” alongside human rights, inclusivity, and social justice [1]. In parallel, the national inclusive education policy framework commits the sector to reducing barriers to learning and participation, and to building an education and training system that accommodates learner diversity rather than treating differences as exceptions [2]. Operationally, policy instruments such as the Screening, Identification, Assessment and Support (SIAS) policy aim to standardize how schools identify learning needs and organize support [3]. At the level of science and technology, national policy has also framed IKS as a strategic resource, socially, culturally, and economically, through the Indigenous Knowledge Systems (IKS) Policy, which emphasizes the protection, promotion, and application of indigenous knowledge [4].

Despite this enabling policy environment, classroom-level enactment remains uneven, especially in rural and historically under-resourced districts. In such contexts, teachers are frequently required to mediate multiple demands simultaneously: delivering curriculum content, differentiating for diverse learning needs, supporting learners’ language and conceptual development, and responding to

community expectations. The Global Education Monitoring (GEM) report on inclusion reiterates that inclusive education is not achieved solely through policy statements; it also depends on teacher capacity, school leadership, resourcing, and context-sensitive pedagogy [5]. Within these constraints, IKS integration is often treated as an “add-on” rather than a principled pedagogical approach that can improve meaning-making, identity affirmation, and epistemic access. This article argues that, when designed intentionally, IKS integration can function as an applied pedagogical technology, an instructional design strategy that enhances inclusion and self-directed learning (SDL) by anchoring inquiry in learners’ lived worlds while progressively bridging to disciplinary concepts.

The article draws on a single-case M.Ed. study conducted at a rural secondary school in the Alfred Nzo West District, Eastern Cape [6]. The focus is on (i) the conditions that enable or constrain IKS integration, (ii) the ways in which IKS-oriented teaching is experienced by teachers and learners, and (iii) the extent to which IKS integration supports learner engagement, inclusion, and SDL-related behaviors. The contribution is twofold. Empirically, the article consolidates the perspectives of teachers, learners, parents, and elders to clarify how IKS integration is enacted and experienced. Practically, it proposes an implementation pathway that can guide schools and districts seeking to institutionalize IKS integration as part of an inclusive, learner-centered pedagogy.

## 2. Conceptual and Literature Background

### 2.1. IKS Integration as Epistemic and Curricular Work

IKS integration in schooling is not merely a matter of adding local examples to existing lessons; it is an epistemic and curricular project that concerns what constitutes legitimate knowledge, who is positioned as a knowledge holder, and how different knowledge traditions are related in teaching and assessment. Odora Hoppers conceptualizes knowledge integration as a form of “articulation” that requires careful attention to power relations and to the conditions under which knowledge systems interact without one being reduced to the other [7]. In science and technology education, calls for integration often emphasize relevance, contextualization, and cultural continuity. Le Grange argues that productive integration depends on creating pedagogical spaces where learners can engage with both Western scientific knowledge and indigenous knowledge without forcing a false equivalence or an assimilationist hierarchy [8]. Similarly, Onwu and Mosimege frame IKS–science dialogue as a deliberate educational practice that supports meaning-making and improves learners’ ability to relate school learning to community life [9].

A useful lens for thinking about this mediation work is the notion of cultural border crossing in science learning. Aikenhead and Jegede explain how learners encounter school science as a cultural practice that may be discontinuous with home knowledge, language, and everyday ways of knowing; teaching strategies that recognize and support border crossing can reduce alienation and promote conceptual access [10]. From this perspective, IKS integration can be understood as an intentional design response to epistemic discontinuity: it provides familiar entry points and validates learners’ identities and prior knowledge while scaffolding movement toward disciplinary concepts, procedures, and explanatory norms.

### 2.2. Inclusion and Inclusive Pedagogy in Rural Contexts

Inclusive education in South Africa is grounded in the commitment to remove barriers to learning and participation, and to create supportive learning environments across the education system [2]. SIAS provides a procedural framework for support planning, emphasizing early identification, appropriate accommodation, and collaboration with district-based support structures [3]. Internationally, UNESCO emphasizes that inclusion is a continuous process requiring system-wide alignment, including policy, curriculum, teacher education, resources, and monitoring, to ensure all learners are meaningfully present, participating, and achieving [5].

A key implication for pedagogy is that inclusion is not primarily a specialized technique reserved for a few learners; rather, it involves expanding what is ordinarily available in the classroom so that more

learners can access and engage with learning. Florian and Black-Hawkins describe inclusive pedagogy as an approach that extends the opportunities available to all, avoids deterministic assumptions about fixed learner ability, and emphasizes responsive teaching that anticipates variability [11]. In rural contexts, where specialist services may be limited, inclusive pedagogy is particularly dependent on teachers' capacity to design multiple pathways into tasks, use accessible language and representations, and draw on community assets, including culturally grounded knowledge and practices.

### *2.3. Self-Directed Learning and Learner Agency*

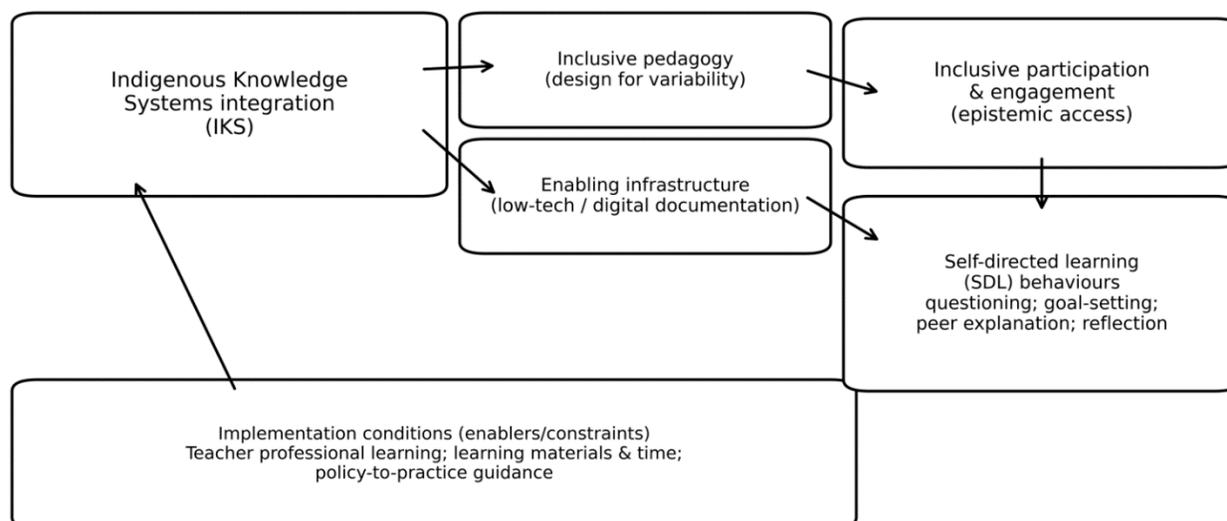
Self-directed learning (SDL) refers to learners' active participation in diagnosing learning needs, setting goals, identifying resources, selecting and implementing learning strategies, and evaluating outcomes. Knowles positions SDL as a capability that can be cultivated through learning experiences that invite learner responsibility and reflection, Knowles [12]. Garrison [13] extends this by emphasizing that SDL involves both self-management of learning tasks and self-monitoring of cognition, and that it is shaped by motivation and context Garrison [13]. Zimmerman's [14] work on self-regulation further highlights how learners develop agency through goal-setting, strategic action, self-observation, and self-reflection [14]. Taken together, these perspectives suggest that classrooms can be designed to make learner agency practical, especially when content is meaningful, inquiry-based, and connected to learners' lived experiences.

### *2.4. Applied Educational Technology as Enabling Infrastructure*

While IKS integration is fundamentally pedagogical, the enabling role of educational technology is relevant in two applied ways. First, South Africa's White Paper on e-Education emphasizes the strategic role of information and communication technologies (ICTs) in transforming learning and teaching, including the development of digital resources and teacher capability [15]. Second, technology can support the documentation and circulation of local knowledge in forms that are learnable and assessable within formal schooling, for example, through audio-visual recordings, digital storytelling, or learner-produced artifacts. Digital storytelling has been described as a practical classroom technology that can integrate narrative, multimodal composition, and reflection, thereby supporting learner voice and engagement [16]. Within an IKS integration agenda, such tools can help preserve community narratives and practices while also supporting inclusive participation by allowing learners to communicate understanding in multiple modes.

### *2.5. Conceptual Synthesis: IKS-Supported Self-Directed Learning in Inclusive Contexts*

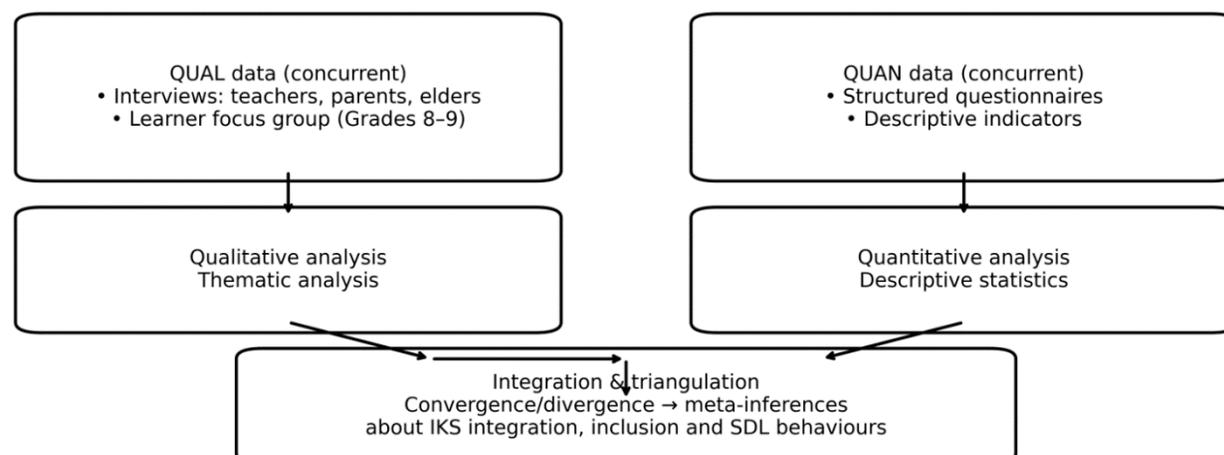
The study views IKS integration as a situated, culturally responsive knowledge practice that can be leveraged to strengthen learner agency and self-regulation when combined with inclusive pedagogy and suitable educational technologies. In this synthesis, IKS operates as a legitimacy resource that affirms learners' identities, a pedagogical resource that provides locally meaningful phenomena for inquiry and problem solving, and a social resource that mobilizes families and elders as co-educators. Technology is positioned pragmatically as enabling infrastructure, for example, to document local practices, curate learner-generated artifacts, and support multimodal representation, while the core instructional work remains epistemic and relational [15, 16]. Figure 1 summarizes this conceptual synthesis.



**Figure 1.** Conceptual synthesis of IKS integration as a catalyst for inclusive participation and self-directed learning (SDL) under enabling/constraint conditions.

### 3. Materials and Methods

This article is based on an M.Ed. dissertation study conducted at a selected rural secondary school in the Alfred Nzo West District, Eastern Cape [6]. The original study employed a convergent mixed-methods single-case design, combining qualitative and quantitative data to examine how IKS was integrated into classroom teaching and how this integration influenced learner engagement and SDL-related outcomes. Mixed-methods designs are appropriate when a single dataset is insufficient to address the complexity of a phenomenon and when different forms of evidence can be integrated to strengthen inference [17]. The convergent mixed-methods design and integration logic are summarized in Figure 2.



**Figure 2.** Convergent mixed-methods single-case design: concurrent qualitative and quantitative data generation, separate analyses, and triangulated meta-inferences.

### 3.1. Site and Participants

The study site was a rural secondary school serving learners from surrounding communities. The participant group comprised 24 individuals: six teachers (teaching Grades 8–9), ten learners (Grades 8–9), four parents, and four community elders [6]. The inclusion of parents and elders was analytically important because IKS is socially held and transmitted, and the legitimacy of community knowledge is a central issue in integration work.

**Table 1.**

Participant profile (M.Ed. case study).

Participant category	Number (n)	Role in data generation
Teachers	6	Semi-structured interviews; questionnaires; classroom practice insights
Learners (Grades 8–9)	10	Focus group discussion; questionnaires; learning experience insights
Parents	4	Semi-structured interviews; home–school perspectives
Community elders	4	Semi-structured interviews; local knowledge and cultural practices

Source: Setsubi [6]

### 3.2. Data Generation

Data were generated through three complementary tools. First, semi-structured interviews were conducted with teachers, parents, and elders to capture their perceptions of IKS, experiences with its implementation, and the perceived effects on learning. Second, a learner focus group explored how learners experienced IKS-based lessons, including perceptions of inclusion, relevance, and learning agency. Third, structured questionnaires were used to capture participants' views on barriers, enabling conditions, and perceived learning outcomes using descriptive indicators [6].

### 3.3. Data Analysis

Quantitative questionnaire responses were analyzed descriptively to identify patterns in perceived barriers and outcomes. Qualitative data were analyzed thematically, following the phases of thematic analysis described by Braun and Clarke [18]: familiarization, initial coding, theme development, review, definition, and reporting [18]. A triangulation logic was employed to compare and integrate evidence from interviews, the learner focus group, and questionnaires, thereby supporting credibility through convergence and explaining divergences where they occurred.

### 3.4. Trustworthiness And Ethics

To enhance trustworthiness, the study used triangulation across participant groups and tools, maintained an auditable analytic trail, and prioritized thick description of context and practice. These strategies align with quality criteria for naturalistic inquiry, including credibility, dependability, and confirmability [19]. Ethical practices included voluntary participation, informed consent for adult participants, assent procedures for learners, confidentiality through anonymization, and attention to power relations in teacher–learner interactions during data generation [6].

## 4. Results

### 4.1. Constraints on IKS Integration in Classroom Practice

Participants reported that IKS integration was valued in principle but constrained in practice by capacity, resourcing, and institutional alignment issues. In questionnaire responses, lack of teacher training was identified as a major barrier (reported by 85% of respondents), followed by limited access to relevant teaching materials (78%), and a gap between curriculum expectations and practical guidance for implementation (70%) [6]. Additionally, resistance or uncertainty among some teachers, often linked to limited confidence in managing knowledge boundaries, was also reported (50%) [6].

A teacher captured the capacity constraint succinctly: “I struggle because we were never trained on how to include IKS in our lessons.” (Teacher A) [6].

Another teacher linked resource constraints to lesson planning: “We want to use local examples, but we do not have enough materials or time to prepare those activities.” (Teacher B) [6].

**Table 2.**

Reported barriers to IKS integration (questionnaire indicators).

Barrier theme	Indicative proportion reporting barrier	Illustrative meaning for implementation
Teacher training and pedagogical capacity	85%	Limited formal preparation for designing IKS-aligned lessons and mediating knowledge boundaries
Teaching and learning resources	78%	Scarcity of locally relevant materials, examples, and time for developing IKS-oriented activities
Policy-to-practice guidance gaps	70%	Uncertainty about assessment, curriculum pacing, and standards for evidencing IKS learning outcomes
Teacher resistance/uncertainty	50%	Concerns about the legitimacy of IKS in formal schooling and the fear of “diluting” disciplinary content

Source: Setsubi [6]

#### 4.2. Learner Engagement, Inclusion, And Participation

Across tools and participant groups, IKS integration was associated with improved learner engagement and more inclusive participation. Teachers and learners described IKS-oriented lessons as more relatable and less intimidating, particularly when learners could draw on family experiences, community practices, and home language resources. Questionnaire indicators suggested increased classroom participation (90%), higher enthusiasm for learning activities (85%), and more positive learner feedback about lessons (88%) when IKS examples and practices were incorporated [6].

One teacher explained the engagement effect through relevance: “When we talk about traditional farming methods, learners become more interested because they see it in their own communities.” (Teacher C) [6].

A learner echoed this connection between familiarity and understanding: “I like it when we discuss things that my grandparents taught me; it makes science easier to understand.” (Learner B) [6].

#### 4.3. Evidence of Self-Directed Learning Behaviors

Participants also linked IKS integration to SDL-related behaviors. Learners reported greater confidence in asking questions, explaining ideas, and initiating learning tasks when lessons began with familiar practices. The questionnaire indicators showed that 80% of learners felt more confident explaining concepts after IKS-integrated lessons, and teachers observed more frequent learner questioning and peer explanations during inquiry activities [6]. These behaviors align with SDL components of learner initiative, strategy use, and reflective evaluation.

A learner described the shift toward initiative: “When we learn using examples from our culture, I feel confident to ask questions and even explain to others.” (Learner D) [6].

#### 4.4. Effective Integration Strategies Reported in the Case Study

The study identified a set of strategies perceived as most workable for IKS integration under rural school conditions. Learner-centred approaches such as group inquiry, discussion, and practical demonstrations were rated as effective by 78% of respondents, while storytelling and narrative explanations were rated as effective by 72% [6]. Community involvement, where elders or parents are invited to share knowledge and contextualize practices, was rated as effective by 65% [6]. However, respondents also indicated that integration remained partial where explicit links to modern scientific concepts and terminology were not consistently developed (58% reported that making these links was challenging) [6].

An elder emphasized the importance of respectful collaboration: “If schools invite us and treat our knowledge with respect, we can help learners understand why our practices work.” (Elder A) [6].

## 5. Discussion

The findings support the argument that IKS integration can strengthen epistemic access, inclusion, and learner agency when it is treated as a coherent pedagogical design rather than a symbolic add-on to the curriculum. From a border-crossing perspective, starting with familiar knowledge and practices reduces the cultural discontinuity that learners may experience in science and technology learning, thereby lowering affective barriers and enabling more confident participation [10]. This is consistent with curriculum scholarship that frames effective IKS integration as dialogic mediation between knowledge traditions rather than the substitution of one for another [8, 9].

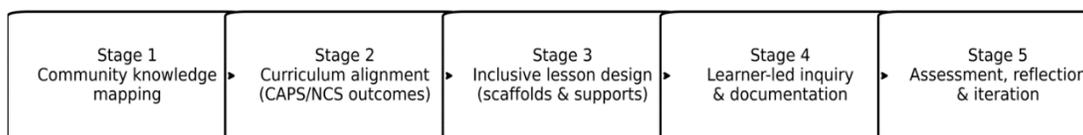
Inclusion-related outcomes in the study can be interpreted through the lens of inclusive pedagogy. When lessons allowed multiple ways of participating, through storytelling, discussion, practical demonstrations, and community narratives, more learners could access the task and contribute meaningfully. This aligns with Florian and Black-Hawkins' [11] emphasis on extending what is ordinarily available to all learners and designing for variability [11]. The results also reflect UNESCO's broader argument that inclusion depends on pedagogical and organizational practices that normalize diversity and enable participation, rather than solely on the presence of policy statements [5].

The SDL-related behaviors reported, questioning, goal-setting in group inquiry, peer explanation, and reflective articulation, are consistent with SDL and self-regulated learning theory. Knowles [12] highlights that SDL is cultivated when learners are positioned as active agents who can use relevant resources to pursue learning goals Knowles [12]. Garrison [13] model further suggests that motivation and context are decisive: learners are more likely to self-manage and self-monitor when learning is meaningful and when they experience competence and support [13]. The case study suggests that IKS integration contributes to these enabling conditions by enhancing relevance and confidence, thereby creating a stronger foundation for learner agency.

Nevertheless, the reported constraints are non-trivial and suggest that policy commitments require systematic capacity-building. The high proportion of participants identifying inadequate teacher training as a barrier (85%) is consistent with broader research, which notes that teachers' pedagogical knowledge and confidence are decisive for curriculum innovation and for mediating knowledge boundaries. Recent South African scholarship on IKS integration in technology education argues for structured frameworks and teacher professional learning that move beyond ad hoc integration [20]. Similarly, De Beer and Kriek [21] demonstrate how teacher professional development interventions can support more sustained integration of indigenous knowledge into science teaching, particularly when theoretical tools help teachers reflect on practice and context [21]. Internationally, evidence reviews of effective teacher professional development emphasize sustained learning opportunities, active learning, coaching, and coherence with curriculum and assessment expectations [22]. The implication is that IKS integration should be planned as a professional learning and resourcing program, not left to individual teacher initiative alone.

## 6. Practical Implications and Proposed Implementation Pathway

To support translation from policy to practice, this article proposes an IKS-enabled inclusive SDL implementation pathway derived from the case study evidence and aligned with curriculum and inclusion policy commitments. The pathway has five stages: (i) community knowledge mapping; (ii) curriculum alignment; (iii) inclusive lesson design; (iv) learner-led inquiry and documentation; and (v) assessment, reflection, and iteration. The pathway is intended to be adaptable rather than prescriptive, allowing schools to scale their level of integration in line with resources and district support. Figure 3 presents the proposed pathway.



**Figure 3.**  
IKS-enabled inclusive self-directed learning (SDL) implementation pathway derived from the case study evidence (five stages).

Stage 1 (community mapping) involves identifying locally meaningful practices, artefacts, and narratives related to curriculum outcomes, and negotiating appropriate roles for parents and elders. Stage 2 (curriculum alignment) requires explicit mapping of IKS examples to CAPS/NCS concepts, skills, and assessment standards [1]. Stage 3 (inclusive lesson design) prioritises scaffolds such as multimodal explanation, group roles, language supports, and flexible output formats aligned with SIAS-informed support planning [3]. Stage 4 (learner-led inquiry) structures learning as investigation and problem-solving where learners generate questions, plan steps, and document evidence, using low-tech or digital tools where available, consistent with the e-Education agenda [15]. Stage 5 focuses on assessment for learning: learners explain and justify connections between IKS and disciplinary concepts, reflect on what they have learned, and teachers refine the design based on evidence.

## 7. Limitations and Future Research

The study is a single-case investigation in one rural secondary school; as such, findings are context-specific and should not be generalized statistically. Questionnaire indicators are descriptive and reflect participants' perceptions rather than externally validated achievement measures. Future research should (i) test the proposed pathway through design-based or intervention studies across multiple schools and districts, (ii) examine learning outcomes using curriculum-aligned assessments, and (iii) evaluate models of teacher professional development and district support for IKS integration. Longitudinal research would also be valuable to determine whether SDL-related behaviors persist and transfer across subjects and grades.

## 8. Conclusion

This article has argued that IKS integration can be operationalized as an applied pedagogical technology that advances two policy priorities simultaneously: inclusive education and learner agency. Evidence from the rural case study suggests that IKS-oriented teaching is associated with stronger engagement, more inclusive participation, and SDL-related behaviors such as questioning, peer explanation, and reflective articulation. However, implementation depends on coherent professional development, context-appropriate learning resources, and clearer curriculum and assessment guidance. The proposed implementation pathway provides a practical organizing tool for schools and districts seeking to move from symbolic recognition of IKS toward systematic integration that improves epistemic access and learning quality.

### Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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