

Whose Knowledge Counts? Decoloniality, Epistemic Justice and the Transformation of Mathematics Classrooms in Africa

Kemi Olajumoke Adu^{1*} 

AFFILIATIONS

¹Department of Initial Primary Education, Faculty of Education, Walter Sisulu University, Komani, South Africa.

CORRESPONDENCE

Email: kadu@wsu.ac.za*

EDITORIAL INFORMATION

Received: 17 July 2026

Revised: 10 September 2026

Accepted: 16 September 2026

Published: 10 October 2026

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DOI: 10.38140/ijss-2026.vol6.2.04

Abstract: Mathematics is presented in African classrooms as universal, neutral and culturally detached (Bishop, 1990; Orey & Rosa, 2024), yet the knowledge selected for formal curricula, the language of instruction and the examples through which mathematics is made meaningful continue to privilege Eurocentric epistemologies while marginalising African mathematical practices and Indigenous ways of knowing. This theoretical article interrogates whose mathematical knowledge is recognised in African classrooms and argues that the peripheralization of Indigenous African mathematical thought constitutes a form of epistemic injustice rather than a neutral curricular preference. Methodologically, it is a Jaakkola-type conceptual theory synthesis terminating in a model, linking decolonial theory, epistemic justice philosophy, ethnomathematics, Indigenous Knowledge Systems and culturally sustaining pedagogy. Four documented African cases serve as analytical illustrations: South African Indigenous games, Akan cultural artefacts in Ghana, Paulus Gerdes's Mozambican ethnomathematics, and the reconstructed traditional Igbo numbering

system of Nigeria. The synthesis yields the Decolonial Epistemic Justice Model for African Mathematics Classrooms, which links four domains of transformation through three mediating processes to four outcome markers. What the model offers that existing frameworks do not is the distinction between mathematical validity and the authority to certify mathematical knowledge, a structure of repair organised by the specific forms of epistemic injustice it names, and observable indicators and boundary conditions for each. The article concludes that transformation requires redistributing epistemic authority rather than inserting cultural examples into an unchanged curriculum. The model is theoretically derived and awaits empirical validation.

Keywords: Informal policing, rural crime prevention, traditional leadership, co-production of safety, community safety, Eastern Cape.

1. Introduction

Few school subjects carry the aura of neutrality as confidently as mathematics. Across African education systems, it is presented as a body of knowledge outside history, culture and politics, whose truths would be identical whether discovered in Alexandria, Athens, Ife or Timbuktu. This presumption of universality makes mathematics the most difficult subject to decolonise and, for the same reason, the most consequential. While history and literature curricula have faced sustained decolonial scrutiny, mathematics has remained insulated by the intuition that a theorem cannot be colonial (Bishop, 1990; Orey & Rosa, 2024).

The intuition confuses two claims. That mathematical propositions can be validated independently of the culture that produced them is one claim. That the selection, sequencing, naming, exemplification, language and assessment of mathematical knowledge in a curriculum are culture-free is a far weaker claim, and it collapses under modest scrutiny. Someone decides which counting systems appear in a textbook, which everyday practices count as mathematics and which are relegated to folklore, which language a learner may reason in during an examination, and whose ancestors are named when the history of a concept is told. These are properties not of mathematics

How to cite this article:

Adu, K. O. (2026). Whose knowledge counts? decoloniality, epistemic justice and the transformation of mathematics classrooms in Africa. *Interdisciplinary Journal of Sociality Studies*, 6(2), a04. <https://doi.org/10.38140/ijss-2026.vol6.2.04>

but of schooling, and schooling in Africa was built by and for a colonial order whose structures of knowledge outlived independence (Quijano, 2007; Ndlovu-Gatsheni, 2021).

This article asks whose mathematical knowledge counts in the African classroom, and what it would take for that answer to change. Ethnomathematics has documented mathematical thinking in African weaving, games, architecture, market computation and numeration for half a century (D'Ambrosio, 1985; Gerdes, 2005; Ogomaka, 2005). What remains underdeveloped is the theoretical articulation between that tradition, the philosophy of epistemic justice and the decolonial critique of the colonality of knowledge. Ethnomathematics shows what African mathematical knowledge exists; decolonial theory explains why it was expelled from legitimacy; epistemic justice names the wrong that expulsion does to learners as knowers; and culturally responsive and sustaining pedagogy supplies part of the classroom grammar for repair. This article's contribution lies in bringing these four literatures into a single argument and drawing a model from it.

The argument is deliberately uncomfortable for the most common form of curricular reform. Adding an African game to a geometry lesson, or a page on Igbo numerals to a textbook, changes the illustrations without changing the epistemic architecture that decides what an illustration is for. If the imported curriculum retains sole authority to certify real mathematics, and Indigenous practice enters only as a motivational bridge, the reform confirms the hierarchy it claims to challenge. Mosimege (2020) asked, from within ethnomathematics itself, what competences learners actually derive from cultural activities whose relevance rests on enjoyment alone. Transformation is a question of epistemic authority before it is a question of content.

The argument must also answer the critical literature on ethnomathematics. Rowlands and Carson (2002) conclude that cultural practice cannot substitute for formal content without disadvantaging the learners it is meant to serve, since the formal apparatus is what renders the mathematics in a practice visible. Pais (2011) argues that ethnomathematics domesticates the knowledge it seeks to honour and culturalises an inequality that is structural and economic. Vithal and Skovsmose (1997) warn that a curriculum organised around learners' own cultural mathematics resembles, in logic if not intent, the differentiated provision apartheid education justified by appeal to culture.

The argument below is constructed to meet these objections. Because it concerns the authority to certify mathematical knowledge rather than the validity of mathematical propositions (section 6.1), it does not propose that cultural practice displace formal content; formal content loses its monopoly on deciding what counts as mathematical while remaining fully available to every learner, and conceptual access becomes an explicit criterion of success. Pais's objection is met by critical vigilance (section 6.4) and by the model's curricular and assessment restructuring domain, both of which treat recognition that leaves sequence and examination untouched as insufficient. Vithal and Skovsmose's warning is met by requiring that all learners hold plural mathematical architectures comparatively, rather than by Indigenous mathematics for Indigenous children.

1.1 Problem statement

This article addresses an epistemic contradiction in African mathematics education: learners encounter mathematics as though legitimate mathematical knowledge exists outside their histories, languages and communities, so that success is often purchased at the cost of their relation to their own inheritance, or what one Mozambican student teacher called "a strong contradiction between school and home, particularly in the mathematics lesson" (Gerdes, 2005, p. 59). Four interlocking conditions sustain it. Curricula reproduce a content sequence, canonical examples and a historiography inherited from colonial sources, so African knowledge enters as an addition to a settled core rather than a claim on how it is organised (Mutongoza, 2025). Instruction in a former colonial language carries epistemological as well as pedagogical costs, regulating who may reason mathematically (Robertson & Graven, 2020). Indigenous knowledge, where it appears, remains

under the teacher's sole interpretive authority, with community knowledge holders seldom present as epistemic authorities (Ajani, 2025). And teachers remain underprepared to teach it, a gap documented from Nkopodi and Mosimege (2009) to Meeran and Niranjan (2026). Marginalisation is therefore structurally produced, yet the dominant reform response remains additive, and the field lacks an integrated conceptual account capable of guiding transformation beyond insertion.

1.2 Research questions and objectives

The article is guided by four interrelated questions.

- How has coloniality shaped what is recognised as legitimate mathematical knowledge in African classrooms?
- In what ways does the exclusion or peripheral treatment of Indigenous African mathematical knowledge constitute a form of epistemic injustice?
- How can ethnomathematical knowledge, local languages, cultural practices and community-based ways of reasoning be incorporated into mathematics teaching without romanticising or tokenising Indigenous knowledge?
- What theoretical principles should guide the transformation of African mathematics classrooms towards decolonial and epistemically just pedagogies?

Four corresponding objectives structure the analysis: to trace the operation of coloniality in the constitution of mathematical legitimacy in African schooling, distinguishing the validity of mathematical propositions from the authority that certifies mathematical knowledge; to specify, using the conceptual apparatus of epistemic justice, the precise character of the wrong done when Indigenous African mathematical knowledge is excluded or peripheralised; to establish theoretically defensible conditions under which cultural knowledge can enter mathematics teaching without being romanticised, folklorised or reduced to motivational decoration; and to synthesise the analysis into a conceptual model that identifies the domains, processes and outcomes of an epistemically just African mathematics classroom.

2. Theoretical Framework

The framework of this article is constructed from four theoretical strands, and the argument depends on their combination rather than on any one of them alone. Two existing syntheses come closest to the combination attempted here, and naming them makes its contribution precise. Orey and Rosa (2024) join ethnomathematics to decolonial commitment through ethnomodelling, but their synthesis is methodological, concerned with how local and academic knowledge are analytically related rather than with what that relation owes a learner. Mutongoza (2025) joins epistemic justice to decolonial theory across four sites of institutional intervention, but works at the level of the academe rather than of a discipline, and does not engage the substantive content of any field. Neither pairs the normative vocabulary of epistemic justice with a documented body of African mathematical knowledge and a classroom pedagogy capable of carrying it. Combining all four is what allows this article to move from the general claim that African knowledge is undervalued to a specification of which wrong is done, to whom, in what forms, and what would count as its repair. Each strand contributes something the others lack, and the order in which they are presented is analytic rather than hierarchical. Decoloniality is taken first because it establishes the historical condition under which the question of legitimate mathematical knowledge arises at all. Epistemic justice follows because it converts that historical condition into a normative claim about particular learners in particular classrooms. Ethnomathematics and Indigenous Knowledge Systems supply the substantive content that the first two strands theorise about, without which the critique would have nothing determinate to defend. Culturally responsive and sustaining pedagogy is taken last because it addresses the classroom itself, which is where the other three strands must finally take effect. Section 4.5 states the synthesis that holds the four together and identifies what each would lack on its own.

2.1 Coloniality and the decolonial turn

The first strand is the decolonial critique of the coloniality of knowledge. Quijano (2007) distinguished colonialism, a political and economic arrangement that formally ended, from coloniality, a durable pattern of power that survives it and operates most powerfully through the organisation of knowledge and rationality. Coloniality installs Eurocentric knowledge as the universal by installing every other knowledge as the local, the traditional or the folkloric. Santos (2018) names the resulting global condition the “cognitive empire” and argues that Northern abyssal thinking has produced “epistemicide”, the active destruction of knowledge rather than merely their neglect. Ndlovu-Gatsheni (2021) develops the argument from an explicitly African vantage point, reading African intellectual production as a struggle for epistemic freedom against a cognitive empire that still governs what counts as knowledge and who is authorised to produce it.

For education, the implication is direct. Mutongoza (2025) maps four sites at which decolonial intervention in African academic life must occur, namely the epistemic, the pedagogical, the institutional and the research domains, and thereby refuses the reduction of decolonisation to curriculum content alone. This article applies the four-site logic below the level of the university to the school mathematics classroom. Decoloniality contributes a diagnosis: the classroom's knowledge hierarchy is not natural but historically installed. What it does not supply is a precise account of the wrong being done to individual learners, and it is here that the second strand becomes necessary.

2.2 Epistemic justice

Fricker (2007) introduced epistemic injustice as a wrong done to someone specifically in their capacity as a knower, and distinguished two forms. Testimonial injustice occurs when a hearer diminishes a speaker's credibility owing to prejudice. Hermeneutical injustice occurs when a gap in the collectively available interpretive resources prevents a person from making sense of, or making intelligible to others, a significant portion of their own experience. Dotson (2011) extends the analysis by identifying practices of silencing, testimonial quieting and testimonial smothering, through which speakers are not merely disbelieved but rendered unable to contribute at all. Dotson's contribution matters here because it accounts for self-silencing: a learner who has internalised that a grandmother's method of computation is not mathematics will not offer it, and the absence will register as though nothing was there.

The apparatus transfers readily to the curriculum. Akbar (2024) argues that curricula which exclude the histories and interpretive frames of marginalised students inflict hermeneutical injustice upon them. Applied to mathematics, the framework allows a shift from the vague claim that Indigenous knowledge is undervalued to the precise claim that particular learners are wronged as knowers in particular ways when particular exclusions are enacted.

2.3 Ethnomathematics and indigenous knowledge systems

The third strand supplies the substantive content that the first two theorise about. D'Ambrosio (1985) established the ethnomathematics programme on the premise that identifiable cultural groups develop mathematical practices that differ substantially from Western academic mathematics, and that mathematics education must account for how such practices evolve into methods and theories. Bishop (1990) sharpened the political edge, arguing that Western mathematics functioned as “the secret weapon of cultural imperialism” (Bishop, 1990, p. 51), carried by three agents, namely trade, administration and, above all, education, and displacing Indigenous mathematical knowledge as it travelled.

The African documentary record on which this article draws was established well before the decolonial vocabulary now used to interpret it. Zaslavsky (1973) founded the field with *Africa Counts*, assembling number systems, games, patterns, and practices of measurement and reckoning from

across the continent, and Gerdes (1994) later reconstructed a body of African geometrical reasoning surrounding the theorem conventionally attributed to Pythagoras. This article inherits that tradition and adds to it the question that the tradition itself did not pose, namely, by what authority the practices it documented were placed outside the category of mathematics in the first place. In Africa, the programme has continued to produce a substantial documentary record. Gerdes (2005) theorised hidden or “frozen” mathematics, his term for the mathematical thinking embedded in traditional techniques that prevailing colonial and neo-colonial frames of reference failed to register as mathematics at all, and proposed unfreezing it as a research and pedagogical operation. Batiibwe's (2024) review of sixty-one studies finds mathematics carried by cultural games, weaving, dance, symbolic calculation, architecture, food preparation and number systems, distributed across measures, number patterns and operations, geometry, algebra, and probability and statistics. The record is continental rather than regional: Owusu-Darko et al. (2023) show that Akan cultural artefacts in Ghana supply pedagogical demonstrations usable in secondary mensuration and geometry. Orey and Rosa (2024) restate the programme in explicitly decolonial terms, proposing ethnomodelling as a dialogic emic-etic methodology connecting local and academic mathematical features.

Indigenous Knowledge Systems scholarship supplies the epistemological grammar that keeps this from becoming extraction. Odora Hoppers (2002) argued that Indigenous knowledge should be neither assimilated into nor subordinated to Western science but articulated with it through a negotiated philosophy of knowledge integration. Chilisa (2020) sets out a postcolonial Indigenous research paradigm grounded in relational ontology and epistemology, which matters here because Indigenous knowledge is constituted relationally and communally and is therefore damaged when abstracted from the relationships that hold it.

2.4 Culturally responsive and sustaining pedagogy

The fourth strand addresses the classroom itself. Ladson-Billings (1995) developed a theory of culturally relevant pedagogy grounded in three commitments: academic success, cultural competence and critical sociopolitical consciousness. The third commitment is frequently dropped in practice, and its loss is precisely what converts culturally relevant pedagogy into cultural decoration. Paris (2012) responded to that drift by proposing culturally sustaining pedagogy, schooling whose purpose is to sustain linguistic, literate and cultural pluralism rather than to bridge learners towards a dominant norm and leave the plurality behind. The distinction is decisive for mathematics. A bridging model treats Indigenous practice as a ramp to imported content and discards it on arrival. A sustaining model treats the plurality itself as an educational aim.

Within African mathematics education specifically, Jojo (2024) demonstrates the classroom feasibility of the approach in a three-year study of two rural South African teachers integrating Indigenous knowledge and everyday artefacts into geometry teaching, reporting improved learner understanding of prisms and pyramids alongside a recommendation for broader ethnomathematical teacher training.

2.5 Synthesis of the framework

The four strands combine into a single analytic logic. Decoloniality explains how the hierarchy of mathematical legitimacy was installed and why it persists; epistemic justice specifies the wrong that hierarchy does to learners as knowers, converting a structural critique into a normative claim; ethnomathematics and Indigenous Knowledge Systems supply the excluded knowledge and the conditions under which it may be engaged without extraction; and culturally responsive and sustaining pedagogy supplies the classroom grammar of redress together with the criterion distinguishing transformation from decoration. None is sufficient alone. Decoloniality without ethnomathematics has no mathematical content; ethnomathematics without decoloniality risks

becoming a catalogue; epistemic justice without pedagogy remains philosophical; pedagogy without epistemic justice becomes technique.

The combination is not frictionless, and one tension between the strands is worth naming rather than smoothing. Fricker's (2007) epistemology is individualist: the bearer of testimonial and hermeneutical injustice is a person whose credibility is deflated or whose interpretive resources are impoverished, and the corresponding repair is a virtue exercised by individual hearers. Chilisa (2020) argues from a relational ontology in which the knower is constituted through community, so that a knowledge claim is not an individual's property to be credited or discredited but a relation to be entered. Taken at face value, the two cannot both be right about where epistemic standing resides, and a framework that simply places them side by side has evaded the question. The resolution adopted here is asymmetrical rather than synthetic. Fricker's apparatus is retained for a diagnostic precision that is unmatched in naming what happens to a particular learner in a particular exchange, but it is relocated inside Chilisa's ontology: the learner whose contribution is received as charming rather than mathematical is wronged as a member of a knowing community and not only as an individual knower, and the community rather than the teacher's personal virtue is the unit in which repair must finally be realised. Dotson's (2011) account of silencing is the hinge that permits the relocation, since testimonial smothering already describes how an individual's testimony is governed by the conditions of a collective. The consequence for the model developed in section 7 is direct, and it is why pedagogical relationality appears there as a domain in its own right rather than as an attribute of good teaching.

3. Methodology

This article is a conceptual study and conducts no new empirical fieldwork. Its methodological warrant follows Jaakkola's (2020) account of conceptual article design, which insists that conceptual work requires an explicit and justified research design rather than an implicit one, and which identifies four such designs: theory synthesis, theory adaptation, typology and model. The present study operates principally as a theory synthesis, defined by Jaakkola as the linking of previously unconnected or incompatible pieces of theory in a novel way, and it terminates in a model. The synthesis links decolonial theory, epistemic justice philosophy, ethnomathematics, Indigenous Knowledge Systems scholarship and culturally responsive and sustaining pedagogy, five bodies of work that overlap in commitment but rarely in citation. The model that follows in section 7 is the synthesis rendered as a set of related domains, processes and outcomes.

3.1 Source selection and analytic procedure

Sources were selected against four criteria. First, theoretical foundation: canonical statements of each framework strand were included regardless of publication date, because conceptual precision requires returning to the texts in which the concepts were defined. Second, African situatedness: priority was given to scholarship produced by African scholars, published in African journals, or grounded in African educational contexts, so that the argument is built from rather than merely applied to the continent. Third, recency: more than half of the works in the final corpus, 21 of 41, were published between 2020 and 2026. Fourth, verifiability: every source is traceable to a publisher record, a digital object identifier or an indexed repository entry.

Source identification proceeded in three steps, reported here so that the procedure can be reproduced. First, the databases and indexes searched were Scopus, Web of Science, ERIC, JSTOR, African Journals OnLine and Google Scholar, supplemented by hand searching of Africa Development, Pythagoras, the Interdisciplinary Journal of Sociality Studies, the South African Journal of Education and the Educational Studies in Mathematics archive for the critical ethnomathematics literature. Second, the search terms were combinations of ethnomathematic*, Indigenous knowledge, mathematics education, decoloni*, coloniality, epistemic justice, epistemic

injustice, language of instruction, multilingual*, culturally responsive and culturally sustaining, each paired with Africa or with the names of individual African countries. Third, screening proceeded from title and abstract to full text against the four criteria above. After duplicates were removed and screening was complete, 41 works constituted the final corpus. Sources were excluded where they reported mathematics education outside Africa with no conceptual bearing on the argument, where ethnomathematics was invoked as a motivational label without mathematical analysis, where publication could not be verified against a publisher record or a digital object identifier, or where a later work by the same author superseded the earlier one. Appendix A sets out the corpus by category, with counts.

This recency proportion of 51 per cent, verifiable from the reference list, is lower than it would be under a narrower reading of the field because the corpus deliberately retains the founding statements of each strand, and those are necessarily older. The search was also restricted to sources available in English. This restriction is consequential for an argument of this kind. It excludes Francophone and Lusophone African scholarship that bears directly on the questions asked here, and in doing so it reproduces within the article's own method a version of the linguistic hierarchy the article criticises. The partial exception is Gerdes, whose Mozambican work is engaged at length through English translation, which is itself an illustration of the point: that record is available to this argument only because it was translated. The restriction is recorded again among the limitations in section 10.

The analytic procedure had three phases. Each literature was first read for its distinctive conceptual contribution, and for the specific question it answers that the others do not. The literature was then read against one another to identify points of productive tension, for example, between the ethnomathematical impulse to document cultural mathematics and the Indigenous Knowledge Systems' insistence that such knowledge is relationally constituted and therefore resistant to documentation. The resulting propositions were finally organised into domains and processes and expressed as a model.

3.2 The case anchors as analytical illustrations

Four documented African cases are used as analytical illustrations rather than as empirical data. They test the framework's descriptive adequacy and give the abstract argument determinate content; they do not establish claims about frequency, generalisability or effect. When this article reports that morabaraba can be linked to quadrilaterals, ratio, symmetry and logical deduction, it is reporting what Nkopodi and Mosimege (2009) documented in two South African provinces, and the claim carries their evidentiary weight and stated limitations, no more.

The first case is South Africa's use of Indigenous games in mathematics teaching, drawing on Nkopodi and Mosimege (2009) and Mosimege (2020) for morabaraba and malepa string figures, on Meeran and Nirajan (2026) for kgati, and on Meeran (2024) and Selepe and Mphahlele (2025) for the contemporary implementation record. The second is Mozambique's ethnomathematical tradition, particularly Gerdes's (2005) work on basket weaving, sona sand drawings and teacher education. The third is Nigeria's traditional Igbo numbering system as reconstructed by Ogomaka (2005). The fourth comprises the Akan cultural artefacts of Ghana documented by Owusu-Darko et al. (2023), which extend the case set beyond Southern Africa and allow the conditions derived below to be tested against a West African record produced independently of the Southern African games literature. The organising logic of the set is the position each case occupies in relation to the school curriculum, and this three-level structure is the principal design feature of the analysis. Games and cultural artefacts sit alongside the curriculum as pedagogical resources; Gerdes's geometry sits inside curricular content as an alternative route to it; and the Igbo numeration system sits beneath the curriculum as a rival architecture for number itself. Reading the framework across these three levels permits it to be examined at increasing depths of epistemic challenge rather than merely in more places, and the cases were selected for that curricular depth rather than for regional

representativeness. The uneven regional coverage that follows from this choice is acknowledged as a limitation in section 10.

3.3 Rigour and reflexivity in conceptual work

Three criteria of rigour were applied. Argumentative transparency requires that each substantive claim be traceable either to a cited source or to an explicitly marked inference of the author. Interpretive fidelity requires that cited empirical work be represented as its authors reported it, including the cautions those authors raised, and this article accordingly foregrounds rather than suppresses the limitations that Nkopodi and Mosimege (2009), Mosimege (2020) and Meeran and Niranjana (2026) attach to their own findings. Conceptual coherence requires that the model be derivable from the framework rather than appended to it, and section 7 makes that derivation explicit.

Reflexivity in decolonial conceptual work carries a particular burden. The argument is written in English and organised by categories, including epistemic injustice itself, that originate in the Northern philosophical tradition it criticises. This is a genuine and unresolved tension rather than an oversight, and it is the tension Santos (2018) identifies when he observes that critique of the cognitive empire is typically mounted from within its institutions. The article's response is to hold the tension visibly, using Northern conceptual tools where they clarify and refusing them where African scholarship supplies a better account, as it does in relational epistemology (Chilisa, 2020), knowledge articulation (Odora Hoppers, 2002) and epistemic freedom (Ndlovu-Gatsheni, 2021).

4. Major Arguments

The arguments developed in this section respond in turn to the four guiding questions set out in section 3, and they are cumulative rather than parallel. The first establishes that what coloniality captured in African mathematics education was the authority to certify mathematical knowledge rather than mathematical truth itself, which is the premise on which the remaining arguments depend. The second uses that premise to specify the wrong that peripheralisation does to learners, showing it to be an epistemic injustice of four distinct kinds rather than a generalised disadvantage. The third turns to the practical difficulty this creates, asking under what conditions Indigenous mathematical knowledge can enter the classroom without being reduced to decoration, and it derives its answer from the four documented African cases read comparatively. The fourth consolidates the analysis into the principles from which the model presented in section 7 is then constructed.

4.1 Coloniality constituted mathematical legitimacy, not mathematical truth

Coloniality shaped African mathematics classrooms not by falsifying mathematics but by capturing the authority to certify it. The distinction is the hinge on which the whole argument turns, because the most common objection to decolonising mathematics assumes that the project must deny mathematical validity. It need not, and this article does not. Bishop (1990) supplied the historical mechanism. Western mathematics travelled with colonialism through three carriers (trade, administration and education), and education was the most consequential because it did not merely impose a notation but installed a criterion. What that criterion certified was not the truth of Pythagoras but the form in which mathematical knowledge must appear in order to be recognised: written, decontextualised, individually assessed, expressed in the colonial language, and validated by an institution rather than by a community of practice. Practices failing those formal conditions were not refuted. They were reclassified. African counting systems became curiosities of ethnography, weaving became craft, and market computation became mental arithmetic of no theoretical interest. Gerdes (2005) captured the resulting condition in the term frozen mathematics, noting that such elements persist in daily life while going unrecognised as mathematics by what he calls "the dominant colonial and neo-colonial ideologies" (p. 49).

Reclassification is more durable than suppression because it does not require ongoing enforcement. Once the criterion of legitimacy is internalised by the institution, by the teacher and by the learner, exclusion becomes self-executing. This is what Quijano (2007) meant by the survival of coloniality after colonialism, and what Ndlovu-Gatsheni (2021) means by a cognitive empire that governs knowledge production without an administrator present. Age and Machaba (2026) show the mechanism operating today, arguing that African Indigenous mathematical practices remain undocumented and therefore curricularly invisible, and warning that new technologies of documentation reproduce the same hierarchy as technological colonialism unless the process is community-governed.

Three features of the contemporary African mathematics classroom follow. The first is the invisibility of African mathematical history: the historiography taught is Greek, Arabic and European, and the African Mathematical Union's Commission on the History of Mathematics in Africa was founded in 1986 precisely to dismantle the Eurocentric bias that continues to dominate that historiography (Gerdes, 2005, p. 52). The second is the asymmetry of exemplification. A curriculum may illustrate proportion with recipes or European architecture without anyone noticing that a cultural choice has been made, whereas illustrating it with sipatsi weaving is immediately marked as cultural and therefore as special. Neutrality, in practice, means resemblance to the dominant. The reclassification can be read directly from curriculum policy. The South African Curriculum and Assessment Policy Statement lists "valuing indigenous knowledge systems" among the principles on which the National Curriculum Statement rests, glossing it as "acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution" (Department of Basic Education, 2011, p. 5). The placement is instructive. Indigenous knowledge is named in the statement of values and general aims, where it figures as heritage, and not in the specification of mathematical content, where it would figure as mathematics, and Meeran and Niranjana (2026) record the practical consequence when they find that curriculum policy does not mandate ethnomathematical content. The third is the erosion of Indigenous systems in use. Ogomaka (2005) documents that the traditional Igbo number system, vigesimal with a decimal sub-base and employing additive, multiplicative and subtractive formation rules, has been displaced by a decimalised system that retains only additive and multiplicative rules and abandons subtractive formation entirely (pp. 39–42). That an entire structural principle of a living numeration system has fallen out of use within living memory, and has done so in the direction of the imported system, is an inference drawn here from Ogomaka's (2005) reconstruction rather than a finding he reports as such, and it is marked as an inference accordingly.

The argument is therefore not that colonial mathematics is false, but that a particular form of mathematical knowledge acquired the exclusive right to name itself mathematics, and acquired it administratively rather than epistemically. Ending that monopoly on certification does not require abandoning the imported content.

4.2 Peripheralisation as epistemic injustice: Four specifiable forms

The claim in this section is stronger than the familiar observation that African learners are disadvantaged. The claim is that the exclusion or peripheral treatment of Indigenous African mathematical knowledge wrongs learners specifically in their capacity as knowers, and that this wrong takes at least four specifiable forms.

The first form is testimonial. When a learner contributes a method learned at home, from a trader, a weaver, a builder or a grandparent, and the contribution is received as charming rather than as mathematical, the learner's credibility as a mathematical knower is deflated on grounds unrelated to the quality of the reasoning. This is Fricker's (2007) testimonial injustice operating at the level of a single classroom exchange, and its aggregation matters more than any instance. A learner who is

heard as a bearer of culture rather than as a producer of mathematics learns, correctly, what kind of knower the institution takes them to be.

The second form is hermeneutical. Fricker's (2007) hermeneutical injustice concerns gaps in the collective interpretive resources available for making sense of one's own experience. In African mathematics classrooms, the relevant gap is the absence of a legitimised category into which a learner's own cultural mathematical practice can be placed. Without such a category, the practice cannot even be brought to the classroom as a candidate for consideration, because there is no recognised name under which it might be offered. Gerdes (2005) recorded the moment of repair when a Mozambican student, having analysed the geometry of the Makhuwa eheleo funnel, concluded that "not all mathematical ideas come from the West" (p. 55). That conclusion had been unavailable to her, not because the evidence was absent, but because the interpretive category was. Akbar (2024) generalises the analysis, arguing that curricular exclusion is a mechanism of hermeneutical injustice rather than merely of underrepresentation.

The third form is contributory exclusion, and Dotson's (2011) account of silencing explains it better than Fricker's. Dotson identifies testimonial smothering, in which a speaker truncates or withholds testimony in anticipation of its unsafe or unintelligible reception. In the mathematics classroom, this is the learner who does not offer the family method at all. The exclusion then becomes invisible to the teacher, who observes only that learners have nothing to contribute, and the observation confirms the deficit narrative that produced the silence. Mosimege (2020) points to the institutional version of the same dynamic when he warns that some educators not only find no use for Indigenous mathematical knowledge but actively discourage its expression, with the effect that learners come to dismiss their own cultural knowledge.

The fourth form is linguistic, and it is the most systemic. Ngũgĩ wa Thiong'o (1986) described colonial language policy as a "cultural bomb", the instrument that severs a people from their own means of self-understanding. In mathematics, the severance is unusually consequential because mathematical reasoning is conducted in language before it is written in symbols. Robertson and Graven (2020) show that English-medium instruction in South African primary mathematics carries epistemological as well as pedagogical costs where English is a first language for fewer than ten per cent of learners, while Setati (2005) shows that teachers' language choices are governed by the political value of English rather than by conceptual need. Mpalami (2022) shows that translating tasks into home languages without a professionally developed mathematical register distorts the tasks. McLachlan and Essien's (2022) review of twenty-seven years of South African scholarship finds a growing language-as-resource orientation coexisting with a marked under-examination of language policy itself, and Munyaradzi (2024) reads the persistence of English hegemony in language policy as reproducing linguistic hierarchy and epistemic injustice. Shuukwanyama et al. (2022) document the reproduction of the problem in teacher education, finding that Namibian mathematics teacher educators endorse mother-tongue instruction for schools while resisting it in their own institutions. The pattern is consistent: language is treated as a medium problem when it is in fact an epistemic access problem.

Naming these four forms identifies four different repairs: changing how learner contributions are received and by whom they are adjudicated; installing legitimated categories, which is curricular and historiographical work; changing the conditions of safety and invitation, which is relational work; and developing mathematical registers in African languages alongside policy that permits reasoning in them, which is institutional work. A reform addressing only one leaves the other three intact, which is why single-strategy interventions consistently underdeliver.

4.3 Integration without romanticisation: what the African cases actually show

How can Indigenous mathematical knowledge enter the classroom without being romanticised, folklorised or reduced to decoration? The four case anchors answer this as much through their authors' cautions as through their positive findings.

The South African games case. Nkopodi and Mosimege (2009) studied morabaraba, a board game of three concentric squares and twenty-four junction points played across South Africa, Lesotho and Mozambique, linking it to quadrilaterals, ratio and proportion, symmetry, strategic reasoning and arithmetic. Learners enjoyed it and showed planning and tactical blocking, and enjoyment was not restricted to one cultural group, supporting use in multicultural classrooms. Mosimege (2020) extends the analysis to malepa string figures, linked to geometric shapes, linear and quadratic patterns and symmetry, and Meeran and Niranjana (2026) link kgati rope skipping to rectangles, measurement, perimeter, estimation and transformations.

The authors' cautions are equally instructive. Nkopodi and Mosimege (2009) report that players communicated in hushed tones and gestures, making reasoning hard to assess; that unequal familiarity with rules disadvantaged novices; and that removing a game from its socio-cultural setting denies learners the context on which understanding depends. Meeran and Niranjana (2026) find that teachers lacked training to extract deeper principles and reproduced misconceptions about measurement, and that policy does not mandate ethnomathematics. Two constraints follow: the game must retain its social context, and the teacher must have the mathematical knowledge to move from play to principle.

The Ghanaian artefacts case. Owusu-Darko et al. (2023) show that Akan cultural artefacts can support the teaching of secondary mensuration and geometry, approaching surface area, volume and the properties of solids through familiar objects. The case shows that the Southern African pattern is not an artefact of where that literature was produced, since an independent West African record yields the same structural position and the same constraint: an artefact's mathematical yield depends on whether it is analysed or merely displayed. It thus widens the argument's geographical base without altering its conditions.

The Mozambican case. Gerdes (2005) offers the deepest model because his method operates on curricular content rather than alongside it. His concept of hidden or frozen mathematics identifies mathematical thinking embedded in traditional technique, and unfreezing recovers it. Students analysing the Makhwua ehelele, a pyramidal basketry funnel, found "new and structurally strong construction methods" for equilateral triangles (p. 54); students analysing sipatsi handbags found that weavers compute common multiples mentally, overturning their assumption that the craft was mere intuition (p. 56). His sona research reconstructs the mathematics of the Cokwe drawing tradition of Angola (p. 51).

Gerdes's aim is not content coverage but "social and cultural mathematical awareness" and "cultural mathematical self-confidence" (pp. 52, 55). His evidence is biographical: Salimo Saide reported that participation let him remember the decorated mats and baskets of his land, and went on to research nembo strip decorations (pp. 58–60). The constraint here is that integration must be intellectually demanding: unfreezing is mathematical analysis, not cultural appreciation, and produces new mathematics.

The Nigerian case. Ogomaka's (2005) reconstruction of traditional Igbo numeration operates beneath content, at the level of the architecture of number. The system is vigesimal with a decimal sub-base (p. 39). Fifteen basic terms, from otu, abuo and ato through iri (ten), ogu (twenty), nnu (four hundred) and puku (eight thousand), combine through additive (iri na ano, fourteen), multiplicative (ogu ato, sixty) and subtractive (bere abuo n'iri, eight) formation, with large numbers built in descending order of value (p. 40). Ogomaka infers that the system's developers understood that multiplication distributes over addition and subtraction (p. 41), an interpretive claim that should be attributed to

him rather than treated as documented Igbo metamathematics and argues that the material is teachable at the primary level and makes computation more meaningful (p. 46). This case establishes that Indigenous systems are alternative architectures rather than simplified precursors, so their value lies in comparison rather than substitution: a learner working in both vigesimal and decimal architectures is doing base theory. Table 1 sets the four cases against one another.

Table 1: Comparative analysis of the four African case anchors

Analytical dimension	South Africa: Indigenous games	Mozambique: Gerdes's ethnomathematics	Nigeria: Traditional Igbo numeration	Ghana: Akan cultural artefacts
Primary sources	Nkopodi & Mosimege (2009); Mosimege (2020); Meeran & Niranjana (2026)	Gerdes (2005)	Ogomaka (2005)	Owusu-Darko et al. (2023)
Cultural practice	Morabaraba board game, malepa string figures, kgati rope skipping	Basketry (ehelelo funnel), sipatsi handbags, sona sand drawings, house building	Vigesimal numeration with a decimal sub-base	Akan artefacts used as pedagogical demonstrations
Mathematical content identified	Quadrilaterals, ratio and proportion, symmetry, transformations, perimeter, logical deduction, arithmetic	Equilateral triangle construction, common multiples, geometric pattern and structure	Base structure, additive, multiplicative and subtractive formation, place value by descending order	Mensuration, surface area and volume, properties of solids, geometric reasoning
Position relative to the curriculum	Alongside the curriculum as pedagogical resource	Inside curricular content as an alternative route to it	Beneath the curriculum as a rival architecture of number	Alongside the curriculum as pedagogical resource
Depth of epistemic challenge	Moderate: mostly motivational and contextual unless mathematised	High: reorganises how geometric knowledge is generated and justified	High: contests the assumed universality of the decimal base	Moderate: contextual and demonstrative unless analysed rather than displayed
Cautions raised by the authors	Quiet play limits assessment of reasoning; unequal rule familiarity; stripping social context; teachers lack training and policy mandate	Requires sustained analytic work and teacher research capacity; risks remaining at the level of appreciation	Distributivity claim is Ogomaka's interpretation of an oral system; the traditional system is already eroding	Yield depends on analysis rather than display; teacher capacity to move from object to principle is again decisive

			towards decimalisation	
The condition it establishes for integration	Contextual integrity and teacher epistemic capacity	Epistemic parity of engagement through unfreezing	Comparison rather than substitution of architectures	Teacher epistemic capacity and analytic rather than illustrative use

Note. Compiled by the author from Gerdes (2005), Meeran and Niranjana (2026), Mosimege (2020), Nkopodi and Mosimege (2009), Ogomaka (2005) and Owusu-Darko et al. (2023).

Read comparatively, the cases yield five conditions for integration without romanticisation. The first is epistemic parity of engagement: the Indigenous practice must receive the same analytic rigour as imported content, which is what unfreezing means. The second is contextual integrity: the practice must retain the social relations that constitute it (Nkopodi & Mosimege, 2009), since relationally constituted knowledge is damaged by abstraction (Chilisa, 2020). The third is teacher epistemic capacity: without sufficient mathematical knowledge, integration reduces to activity (Meeran, 2024; Meeran & Niranjana, 2026; Nkopodi & Mosimege, 2009; Owusu-Darko et al., 2023; Selepe & Mphahlele, 2025). The fourth is community authority: holders of communal knowledge must have standing in the classroom (Age & Machaba, 2026; Odora Hoppers, 2002).

The fifth is that integration must be able to change the curriculum, not only be changed by it. If Indigenous knowledge may enter only where it maps onto an existing objective, the curriculum retains its monopoly on certification, and the reform is decorative. Visnovska et al. (2025) illustrate the alternative, reinventing length measurement so that the Indigenous starting point reorganises the sequence rather than illustrating it.

4.4 Principles for transformation

The preceding analysis consolidates into five principles, each derived from a specific analytic finding rather than asserted.

The first is epistemic plurality without relativism. The classroom should recognise multiple legitimate mathematical traditions while retaining rigorous standards of reasoning within each. This follows from the distinction established in section 6.1 between mathematical validity and the authority to certify mathematical knowledge, since plurality concerns the second and not the first. Ogomaka's (2005) vigesimal system is not true instead of the decimal system; it is an alternative structure whose internal logic is as demanding, and holding both is more rigorous than holding either. The second is redistributed epistemic authority. Certification of what counts as mathematical knowledge must be shared among the curriculum, the teacher, the learner and the community rather than monopolised by the first. This follows from the analysis of contributory exclusion and from Odora Hoppers's (2002) articulation model, and it has a concrete test: can a learner's contribution change what the class treats as the mathematical object of study, or only illustrate what was already decided? The third is linguistic justice as epistemic access. Learners must be able to reason mathematically in the languages in which they think, which requires developing mathematical registers in African languages rather than merely permitting translation (McLachlan & Essien, 2022; Mpalami, 2022).

The fourth is relational pedagogy with community standing. Because Indigenous knowledge is relationally and communally constituted (Chilisa, 2020), its classroom presence requires the presence, direct or mediated, of those who hold it, which rules out the extraction model in which the teacher collects cultural content and delivers it without the relationships that make it knowledge. The fifth is critical vigilance against tokenism. Every integration must be interrogated for whether it

disturbs or confirms the existing hierarchy, and the criterion is Paris's (2012) distinction between bridging and sustaining. Vigilance is equally required against the mirror error of romanticisation, in which Indigenous practice is credited with sophistication it does not possess. Both errors are refusals to engage the practice on its own terms, and Mosimege's (2020) scepticism about enjoyment as a sufficient criterion is the internal model for such vigilance.

5. A Model of the Epistemically Just Mathematics Classroom

The five principles and five integration conditions established above can be organised into a single conceptual model. Figure 1 presents the Decolonial Epistemic Justice Model for African Mathematics Classrooms.

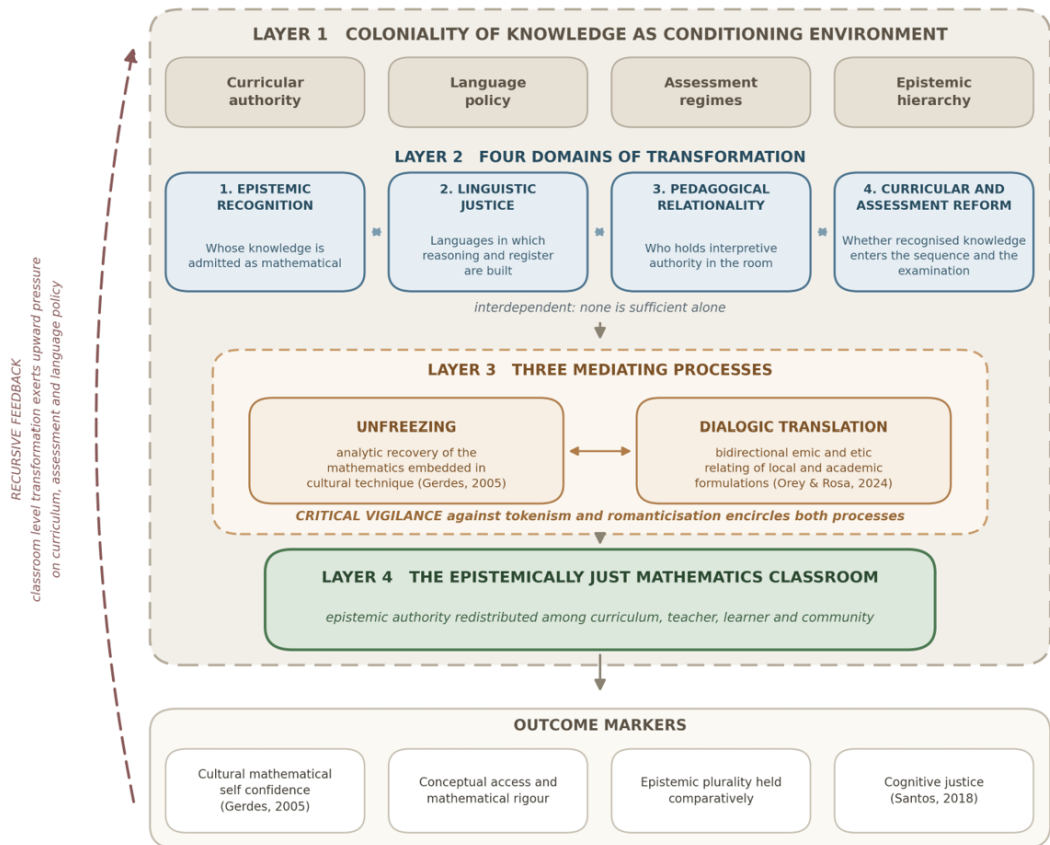


Figure 1: The decolonial epistemic justice model for African mathematics classrooms

Note. Developed by the author from the theory synthesis presented in sections 4 and 6. Concepts drawn from Gerdes (2005), Orey and Rosa (2024), Paris (2012), Quijano (2007), Ndlovu-Gatsheni (2021) and Santos (2018). The figure is the author's own work. No element is adapted from a published source, and no copyright permission is therefore required. Alternative text: a conceptual model in four layers. An outer field labelled the coloniality of knowledge carries four conditioning expressions across its top: curricular authority, language policy, assessment regimes, and epistemic hierarchy. Within the field, four interconnected domains of transformation are shown: epistemic recognition, linguistic justice, pedagogical relationality, and curricular and assessment restructuring. Inside these sit three mediating processes: unfreezing and dialogic translation, encircled by critical vigilance. Beneath the field, an outcome band names the epistemically just mathematics classroom and its four markers: cultural mathematical self-confidence, conceptual access, epistemic plurality and cognitive justice. A feedback arrow runs from the outcome band back to the outer field.

5.1 Interpretation of the model

The model is read as four nested layers set within a conditioning field, with an outcome band beneath it. Each layer answers a different question.

Layer 1 names the conditioning environment. Coloniality of knowledge is the field within which the classroom sits, rather than an external force, because the classroom was historically constituted under its terms (Quijano, 2007; Ndlovu-Gatsheni, 2021). Four expressions of this conditioning are named: curricular authority, the monopoly on certification analysed in section 6.1; language policy, which regulates the medium of reasoning; assessment regimes, which enforce certification on the individual learner; and epistemic hierarchy, the internalised criterion that makes the other three self-executing. Classroom interventions that leave these untouched will be absorbed rather than prove transformative.

Layer 2 names the four domains of transformation. These correspond to the forms of epistemic injustice in section 6.2, since repair should follow the anatomy of the harm. Epistemic recognition concerns whose knowledge is admitted as mathematical, answering testimonial and hermeneutical injustice. Linguistic justice concerns the languages in which mathematical reasoning may be conducted. Pedagogical relationality concerns who holds interpretive authority, answering contributory exclusion. Curricular and assessment restructuring concerns whether recognised knowledge can enter the sequence and the examination, without which the other three remain rhetorical. The domains are interdependent: recognition without assessment restructuring yields enrichment activities with no institutional weight, while assessment restructuring without linguistic justice examines learners in a language that constrains their reasoning.

Layer 3 names three mediating processes that convert domain commitments into practice, forming the model's operational core. Unfreezing (Gerdes, 2005) is the analytic recovery of mathematical thinking embedded in cultural practice, distinguishing epistemic parity from illustration. Dialogic translation, drawing on Orey and Rosa's (2024) ethnomodelling, relates local and academic formulations bidirectionally without subordinating either; one-directional movement towards academic mathematics is the bridging model Paris (2012) criticises. Critical vigilance, the reflexive interrogation of each integration for tokenism and romanticisation, encircles the other two as a continuous condition of their integrity.

Layer 4 names the outcome state, the epistemically just mathematics classroom, recognised by four markers. Cultural mathematical self-confidence, Gerdes's (2005) criterion, is evident when learners locate themselves in the history of mathematical thought. Conceptual access guards against substituting cultural affirmation for mathematical learning (Meeran & Niranjana, 2026; Mosimege, 2020). Epistemic plurality is evident when more than one mathematical architecture is held comparatively. Cognitive justice (Santos, 2018) is evident when the classroom's knowledge hierarchy has actually shifted rather than been decorated.

Because the model is to be tested empirically (section 10), Table 2 specifies an observable indicator for each marker.

Table 2: Observable indicators for the four outcome markers

Outcome marker	Observable indicator	Where the evidence would be found
Cultural mathematical self-confidence	Learners locate themselves and their communities in the history of mathematical thought, and offer home or community methods unprompted in mathematical rather than anecdotal register	Classroom discourse records; learner interviews; frequency and framing of learner-initiated contributions across a term

Conceptual access	Performance on standard curricular assessment is maintained or improved alongside plural-architecture tasks, with no trade-off between cultural engagement and mathematical attainment	Comparison of curricular assessment results before and after implementation; performance on items requiring reasoning across architectures
Epistemic plurality	Learners work comparatively in more than one mathematical architecture and can state the structural principles of each, for example converting and reasoning between vigesimal and decimal bases	Task performance on comparative base and structure items; written and oral justification of method choice
Cognitive justice	Learner and community contributions change what the class treats as the mathematical object of study, and recognised knowledge enters the taught sequence and the assessment rather than only the lesson introduction	Lesson sequence and scheme of work documents; assessment items; records of whose contributions altered subsequent planning

Note. Developed by the author from the outcome markers in section 5.1; the conceptual access indicator follows Mosimege (2020) and Meeran and Niranjana (2026).

The feedback arrow from the outcome band to Layer 1 carries the model's boldest claim: classroom transformation is not merely an effect of structural change but a source of pressure upon it. This is a hypothesis rather than a finding. Gerdes's (2005) student teachers, who left his courses determined to serve their communities and honour their cultural inheritance, suggest that classroom work can generate institutional change, but they are few and were recorded by their own teacher. The model is nonetheless recursive rather than linear, distinguishing it from implementation models in which policy descends to practice.

5.2 What the model rules out

A model earns its keep as much by what it excludes as by what it prescribes, and the structure rules out three common reform patterns. Additive insertion, in which African examples are placed into an unchanged curriculum, operates only in the epistemic recognition domain and leaves curricular and assessment restructuring untouched, so the inserted content carries no institutional weight. Linguistic accommodation without register development fails because dialogic translation cannot be bidirectional where a mathematical register exists in only one language, which is Mpalami's (2022) finding stated in the model's terms. Cultural celebration without mathematical analysis bypasses unfreezing entirely, and it is the pattern against which Mosimege (2020) and Meeran and Niranjana (2026) both warn from inside the ethnomathematics tradition.

The model also has boundary conditions, and stating them is part of specifying what it claims. It is constructed for systems in which the language of instruction is a former colonial language, in which certification is enforced through high-stakes external examination, and in which the mathematics curriculum derives its content sequence from metropolitan sources. Where any of these does not hold, the model applies differently rather than automatically. In classrooms where the language of instruction is already an African language, the linguistic justice domain shifts from the right to reason in a home language to the adequacy of the mathematical register available in it, which is a question of resourcing rather than of permission, and Mpalami's (2022) finding becomes the central rather than a supporting consideration. In systems without high-stakes external examination, the curricular

and assessment restructuring domain loses much of its leverage, and epistemic recognition may carry institutional weight without it, so the claim that assessment restructuring is determining should be expected to hold weakly or not at all. Where Indigenous mathematical knowledge is not held communally, or where the relevant practices have been lost rather than peripheralised, the community authority condition cannot be met in the form specified, and the question becomes one of recovery, with all the hazards of reconstruction that the Nigerian case illustrates. The model is not offered as a universal account of mathematics education and does not travel unchanged to contexts whose coloniality took a different form.

6. Conclusion

This article asked whose mathematical knowledge counts in African classrooms. Four conclusions follow. First, the marginalisation of African mathematical knowledge results from coloniality's capture of the authority to certify mathematics, not from any deficiency in that knowledge or falsity in the imported content. The critique of mathematical coloniality is therefore not a critique of mathematics. Second, the exclusion of Indigenous African mathematical knowledge constitutes epistemic injustice in four forms (testimonial, hermeneutical, contributory and linguistic), each requiring a different repair. Third, integration without romanticisation or tokenism is possible, but only under conditions the African cases themselves establish: epistemic parity, contextual integrity, teacher epistemic capacity, community authority, and the capacity of Indigenous knowledge to change the curriculum rather than merely be accommodated by it. Fourth, transformation requires redistributing epistemic authority rather than diversifying content. The distinction between the validity of a claim and the authority to certify it is portable to other disciplines that ground their neutrality in their methods, such as statistics, economics and medicine.

Mathematics is thus the decisive test case for African educational decolonisation. If the discipline most confident of its neutrality carries a knowledge hierarchy that can be transformed without loss of rigour, the supposed tension between decolonisation and academic quality loses its strongest example. Learners who reason across vigesimal and decimal systems, analyse the geometry of a weave and think in their own language are doing more mathematics, not less.

6.1 Recommendations

The recommendations are addressed to the actors who can act on them. Curriculum authorities should teach Indigenous African mathematical systems as content rather than illustration, including African numeration systems taught comparatively with the decimal system (Ogomaka, 2005), should mandate rather than permit ethnomathematical content (Meeran & Niranjana, 2026), and should include African contributions in the history of mathematics (Gerdes, 2005). Assessment bodies should develop examination items that require reasoning across mathematical architectures, offer assessment in the African language of instruction where applicable, and accommodate the collaborative and oral modes of Indigenous mathematical reasoning (Nkopodi & Mosimege, 2009). Teacher education institutions should build ethnomathematical content knowledge, not mere awareness, into initial teacher education (Meeran & Niranjana, 2026; Selepe & Mphahlele, 2025), using low-cost optional courses and circles of interest (Gerdes, 2005), and should address educators' resistance to mother-tongue instruction within their own institutions (Shuukwanyama et al., 2022).

Within schools, leaders and teachers should adopt unfreezing as a lesson design habit, invite community knowledge holders as authorities rather than guests, and test each integration by asking whether a learner's contribution could change what the class treats as the mathematical object of study. Those responsible for language policy and materials development should develop mathematical registers in African languages professionally rather than through ad hoc translation (Mpalami, 2022) and build freely available corpora of translated tasks and terminology (McLachlan & Essien, 2022). Researchers should test the model empirically, particularly the determining role of

assessment, extend documentation beyond the Southern African games literature (Batiibwe, 2024), and address community governance of Indigenous knowledge recorded with artificial intelligence (Age & Machaba, 2026). These measures differ in cost and political exposure. Unfreezing, optional courses and community involvement can begin immediately within existing resources; curriculum mandates and revision of the history of mathematics require institutional decision but little expenditure; African-language registers and examination restructuring require long-term system investment. Classroom-level measures can therefore proceed first and, if the recursive claim in section 7.1 holds, generate the demand that makes system-level change feasible.

6.2. Limitations and future research

Five limitations qualify these claims. First, the model is theoretically derived, not empirically validated; its propositions, notably the determining role of assessment, are hypotheses. Second, the case anchors come from four countries and an uneven documentary record dominated by Southern African scholarship. Third, the article uses English and Northern conceptual categories (section 5.3), and the English-only search excluded Francophone and Lusophone scholarship. Fourth, learner and teacher voices enter only as reported in the cited studies. Fifth, the evidence for the integration conditions is thin and partly historical, resting on a few secondary reports, two of which date from 2005 and 2009. Future research should therefore engage learners and teachers directly and broaden the case base; test whether redistributed epistemic authority produces the model's four outcome markers; use design-based research to identify the teacher preparation that enables unfreezing; and examine longitudinally whether classroom transformation generates upward pressure on curriculum, assessment and language policy, or whether structural change must come first

7. Declarations

Funding: This research did not receive any external funding.

Acknowledgements: The author makes no acknowledgement.

Conflicts of Interest: The authors declare no conflict of interest.

AI Usage: The author used an artificial intelligence assistant during the preparation of this manuscript for language editing, to structure and understand the reviewer comments. The conceptual argument, the selection and reading of sources, the analysis and all interpretations are the author's own, and the author takes full responsibility for the content of the manuscript.

Data Availability: This review is based entirely on publicly available data and information sourced from peer-reviewed articles, reports, and other academic publications cited in the manuscript. No new primary data were generated or analysed during this study. Readers may refer to the cited sources for detailed information.

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Appendix A: Composition of the Source Corpus

The table below sets out the 41 works in the final corpus by category, with the number published between 2020 and 2026 in each. It provides verifiable evidence that the inclusion criteria stated in section 5.1 were applied and allows the recency claim to be checked against the reference list.

Category	Works	Published 2020–2026	Examples
Decolonial theory and epistemic justice philosophy	9	4	Fricker (2007); Quijano (2007); Santos (2018); Ndlovu-Gatsheni (2021); Mutongoza (2025)
Ethnomathematics: foundations and critique	9	1	D'Ambrosio (1985); Zaslavsky (1973); Bishop (1990); Vithal and Skovsmose (1997); Rowlands and Carson (2002); Pais (2011)
African ethnomathematics: documented cases and reviews	10	8	Ogomaka (2005); Nkopodi and Mosimege (2009); Mosimege (2020); Owusu-Darko et al. (2023); Batiibwe (2024); Meeran and Niranjana (2026)
Language, multilingualism and mathematical register	5	4	Setati (2005); Robertson and Graven (2020); Mpalamu (2022); McLachlan and Essien (2022)
Indigenous Knowledge Systems and culturally responsive or sustaining pedagogy	6	3	Ladson-Billings (1995); Odora Hoppers (2002); Paris (2012); Chilisa (2020); Jojo (2024)
Methodology and curriculum policy documents	2	1	Jaakkola (2020); Department of Basic Education (2011)
Total	41	21 (51 per cent)	

Note. Compiled by the author. Counts refer to the 41 works in the reference list. The search and screening procedure is described in section 3.1.

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