

The African Mother Tongue and Mathematical Ideas

A Diopian Pluridisciplinary Approach

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Series in Language and Linguistics



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Note about the Image: The Mancala is a game board that allows two players to test each other's linguistic and mathematical prowess.

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Dedication

Africans everywhere, who must keep the struggle alive and triumph!

My Humble Maxim for Africans: Seeing is natural, looking spontaneous, and noticing can be incidental to both. Paying attention must be voluntary, examining requires attention, and analysis demands sustained attention. While earlier African thinkers set standards, we must extend insights to problems they did not discuss. The extent to which we can agree, disagree or be puzzled by any contemporary work on Afrika and its people should be a measure of its achievement.

Acknowledgments

I, and hopefully many readers, owe gratitude to the following:

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Preface

Using Cheikh Anta Diop's pluridisciplinary approach (i.e. the analysis of an African phenomenon by utilizing the tools of two or more disciplines, with the result in turn contributing to the epistemology of each discipline), this book, which is overwhelmingly sociolinguistics using mathematical ideas as evidence that even a non-mathematics student can understand, is an expansion of my award-winning article titled "Domesticating Mathematics in the African Mother Tongue" that appears in *The Journal of Pan African Studies* (vol. 6, no. 1, 2014:12-58). The article deals with why and how African-centered mathematical ideas can be a driving force in Africa's development efforts. I first argue in the article that Africa being the center of mathematics history for tens of thousands of years is hardly a matter of dispute. From the civilizations across the continent emerged contributions which would enrich both ancient and modern understanding of nature through mathematics. Yet, today, I add, scholars and other professionals working in the field of mathematics education in Africa have identified a plethora of problematic issues in the endeavor. I also argue that a major reason for these problems is that the African mother tongue has been greatly neglected in the teaching of mathematics in the continent. I then call for the situation to be changed if Africa is to benefit from the tremendous opportunities mathematics offers. I further show that while a great deal of works exists on the connections between linguistics and mathematics in general, few can be found on the nexus between African languages and mathematics in particular, and these latter works are not linguistics-theoretically grounded. Thus, I begin by identifying the objects of study of linguistics and mathematics and delineate which ones they study in common in the article. Next, since the object of study of linguistics is language, the nine design features of language are employed to examine each of the objects as it pertains to African languages. After that, mathematical ideas of sustainability and those of tipping points are suggested as means to help Africa's development efforts.

The book, therefore, aims to provide ample empirical evidence to show that African languages exhibit all nine design features that can facilitate the domestication of mathematics for effective learning. But since European languages have been privileged over African languages in mathematics education in the continent, the book must do at least two very important things, if we are to remedy the problems so that Africans can benefit from the tremendous opportunities mathematics offers. First, the book must offer material for schools to encourage the use of African languages in order to

nurture and promote those languages vis-à-vis mathematics education. Second, the book must also provide evidence for why more research on the connection between language and the learning and teaching of mathematics from a sociopolitical point of view is necessary.

This book is therefore suitable as a main or supplementary text for undergraduate and graduate students taking courses in African Studies, Education, Mathematics, and Linguistics. It also is useful for professors teaching about and scholars conducting research in these areas. In addition, policy makers in these areas would be interested in the valuable information that the book provides. Furthermore, relevant political activists and advocacy groups would be interested in the book to pursue their objectives.

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Summer 2019

Foreword: Africity and the Language of Mathematics

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There is no gain reiterating the normative privileging of western languages over languages from Africa as well as the marginalization of Africa in many areas of global and human development. As noted by Anchimbe, through the colonial and missionary education projects, these languages took root in the education systems in many parts of Africa.¹ In various academic disciplines around the continent, the languages of instruction since colonialism have remained acquired western languages. Fafunwa is of the opinion that the languages imposed on Africa as a result of the continent's contact with colonialism constitute a major obstacle to the effective dissemination of knowledge and skills which, in turn, impact the socio-cultural and economic development of the nation.² Bangura's multidisciplinary book deftly marshals evidence from linguistics, mathematics, history, archaeology, computing, engineering, development studies, sociology, education and more to link the continent's past, present and future in a manner that will intrigue and excite debate among scholars of Africa for a long time to come. Therefore, with the above background, this essay reviews Bangura's *The African Mother Tongue and Mathematical Ideas*.

Language provides contextual understanding of ideas, subjects, and society; therefore, its role in broadening horizons and accelerating assimilation in

¹ Eric A. Anchimbe, "Functional Seclusion and the Future of Indigenous Languages in Africa: The Case of Cameroon," in *Selected Proceedings of the 35th Annual Conference on African Linguistics*, ed. John Mugane (Somerville, MA: Cascadilla Proceedings Project, 2006), 94-103.

² Aliu Babs Fafunwa, *Education in Mother Tongue: The Ife primary education research project (1970-1978)* (Ibadan: University of Ibadan Press 1989).

various academic disciplines cannot be overemphasized. The use of the mother tongue will no doubt be more effective in teaching, especially given the relevance of context and the plethora of familiar examples at the teacher's disposal to instruct and achieve effective learning. For the learner, Fafunwa observes that it also affords him/her a wide imaginative space for expression and thought and therefore gives room to meaningful education.³

In the field of mathematics, western languages have been adopted in the impartation of mathematical knowledge and ideas. This can, however, be linked to Bangura's observation in the text that mathematics scholars like Papakonstantinou and Tapia opine that Africans had no prior knowledge of Algebra. It can, therefore, be inferred that African languages are considered unsuitable for the teaching of mathematics. This implied unsuitability has its roots in the perceived inferiority of African languages and knowledge systems which were further subdued by the incursion and dominance of colonial and missionary pedagogy. Bangura's book, however, counters this notion and explores the nexus between mathematics and African languages. It identifies distinct objects of study for the areas of linguistics and mathematics while also outlining the objects of commonality. The work equally identifies nine design features of language and uses them to examine African languages, to reveal that African languages are fully equipped with these design features and are therefore effective for the domestication and study of mathematics to suit the African context.

Judging from the above findings, the book also advocates for the centrality of African ideals and perspectives, as well as the use of the mother tongue in the teaching and exploration of mathematical ideas so as to access the benefits that the discipline has to offer. This, however, stems from Bangura's notion that mathematical ideas centered on African epistemes can be an effective force towards efforts geared at Africa's development.

In the first chapter, the book explores the mother tongue and the study of mathematics from the perspective of African centrality. This is primarily as a result of the pertinence of central African ideals in the teaching and understanding of mathematics within the continent. According to Chawane, African centrality could be defined in terms of its (or as) methodology, theory, and ideology. However, while defining it as a methodology, it can be viewed as a response to the intellectual colonialism that tends to justify and validate socio-political and economic colonialism. As a theory, the term can be defined by placing the African at the core or center of any inquiry with reference to African behavior and action. Finally, as an ideology, the concept

³Aliu Babs Fafunwa, *Education in Mother Tongue*.

refers to the African desire for an ideological bond against external interference.⁴ In other words, from any perspective it is viewed, the concept calls for the centralization of the consciousness of an African identity in the processes of African development.

The chapter also goes further to provide a brief history of African-centricity while also exploring various research questions and theories emanating from the concept to educate the African people on the relevance of a central African perspective in their understanding of self and their application of such understanding in various areas of their development. With reference to the terminology, Mashengele is of the opinion that Africans need to answer the question of who defines their history and knowledge as well as whose history they know.⁵ In other words, a consciousness of self; that is, the interpretation of knowledge from an African perspective should be the heart of African development and education.⁶

However, prior to above exploration, with a detailed and relevant background of mathematical publications, this book implies that there are some limitations to the research done and knowledge represented by some of the works analyzed therein that alienate Africa from the history of Algebra. Also, with the same degree of motivation, the work provides evidence buried within famous mathematical publications from several writers like Cheikh Anta Diop, which clearly reveal that Ancient Kemet/Egypt is the origin of Algebra that Bangura broadly sees as “Algebraic mathematical series, simple equations, quadratic equations, balance of quantities.” Therefore, by providing evidence that Africa is the history of Algebra and countering contradictory opinions, Bangura’s work contributes to African renaissance and tries to expel the African mathematical history from the margins of global mathematical inventions.

Also, by advocating a centrally African perspective in the study of mathematics, the book, as earlier stated, identifies nine design features of language and extensively discusses and examines each of these nine features with regards to its correlation to African languages and mathematics. The nine design features include the following; (1) mode of communication, (2) semanticity, (3) pragmatic function, (4) interchangeability, (5) cultural transmission, (6) arbitrariness, (7) discreteness, (8) displacement, and (9) productivity. To express their relevance in identifying the adequacy of African

⁴ Midas Chawane, “The development of Afrocentricity: A historical survey”, *Yesterday and Today* 16, 2016: 78-99.

⁵ Danny Mashengele, “Africentricity: New context, new challenges, new futures,” (paper presented at the 27th Annual SCUTREA Conference, University of London, 1-3 July, 1997), http://www.leeds.ac.uk/bei/Education-line/browse/all_items/42755.html

⁶ Midas Chawane, *The development of Afrocentricity*, 78-99.

languages in facilitating the teaching of mathematics, the work compartmentalizes their examination into nine chapters starting from the third chapter.

Having identified the nine design features of language, the second chapter engages in detailed, albeit separate definitions of language for the fields of linguistics and mathematics. It also goes further to provide a brief explanation of how the connection between both fields of study emerged. To provide the data relevant for the exploration, the study extensively examines the content of several publications to proffer necessary definitions and historical materials that provide a description of the connection between both distinct fields of study. With the relevant information provided in this chapter, the book sets a tone for the succeeding chapters which provides in-depth knowledge on the nine design features of linguistics with reference to African languages and the teaching of mathematics.

In the third chapter, using three sections, the work examines language as a mode of communication. It explores the linguistic expositions on the mode of communication and within this linguistic expositions the work identifies ten themes, which include: (1) system of communication, (2) communication theory, (3) communicative grammar, (4) types of communication, (5) communicative effect taxonomy, (6) indices of communication and communicativity, (7) communicative act and strategies, (8) communicative function, (9) communicative power, and (10) language development. The second section examines the linguistic evidence that shows that African languages have successfully devised several methods in which language can be used for effective communication just like other languages across the globe. In the final section, the work provides evidence that shows that African languages possess mathematically communicative acts in the vocalization and gestures of counting that serve communication purposes within the continent.

However, by elaborately analyzing these communication elements and approaches in African languages, the work reaffirms the suitability and adequacy of African languages in effectively passing across information irrespective of the complexity or abstract nature of the information. Also, by providing evidence that shows that African languages possess mathematical communicative acts, the work gives credence to its initial claims that Africa is the origin of Algebra and her languages possess the necessary tools for the teaching and understanding of mathematics. This, therefore, implies that the continued use of European languages in the teaching of mathematical ideas is hardly as a result of an absence of choice amongst African indigenous languages but rather the colonial conditioning of western language superiority and the lasting effect of language imperialism. It also enforces the

opinion that for more effective teaching and learning of the subject, scholars of mathematics should employ the use of indigenous African languages.

In the fourth chapter, the work examines the place of meaning (semantics) in the communication of mathematical ideas. This part of the text implies that the primary need for the adoption of the mother tongue as the language of instruction for mathematics is the benefit of efficient mathematical communication between the speaker and hearer that share common languages and therefore more likely to understand the ideologies being discussed. This must be in line with Trudell and Schroeder's opinion that "learning to read and write is a psycholinguistic and social process."⁷ They also go ahead to affirm that African language speakers tend to assimilate and learn better when taught in the language they speak. For Love, "languages are systems of correspondences between two levels of structure, one of which is called form and the other which is called meaning. The native speaker of a language is said to know the set of forms comprised by the language and the set of meanings that correspond to them".⁸ Therefore, communication between teacher and student is possible and even effective because both teacher and student understand the correspondence of form and meaning resident in the language in use. To expand on the semantics in language this chapter also addresses three subtopics, including linguistic expositions on the subject; African linguistic evidence; and African mathematical evidence.

The third of the nine design features of language, which constitutes the fifth chapter of the text deals with the pragmatic function of languages. It explores the idea of pragmatic function and then goes further to establish and analyze the nexus between African languages and mathematics. Language as a communication system tends to serve a useful purpose, and this purpose characterizes the pragmatic function of the language. However, to extensively discuss the pragmatic function of language, the chapter is sectionalized into three parts like the chapters before it. This part includes the linguistic expositions on the subject, the African linguistic evidence, and the mathematical evidence. In the first part, the work explores extensively, a variety of pragmatic function in language that Professor Bangura labeled as (a) deictic functions; (b) conversational implicatural functions; (c) presuppositional functions; (d) speech act functions; (e) conversational

⁷ Barbara Trudell and Leila Schroeder, "Reading Methodologies for African Languages: Avoiding Linguistic and Pedagogical Imperialism," *Language, Culture and Curriculum* 20, 3 (2007): 165-18. <https://www.tandfonline.com/doi/abs/10.2167/lcc333.0>.

⁸ Nigel Love, "Translational semantics: A discussion of the second edition of Geoffrey Leech's *Semantics: the study of meaning*," *Stellenbosch Papers in Linguistics* 11 (1983): 115-136.

structural functions; (f) ideational, interpersonal, and textual functions; (g) tact maxim functions; (h) communicative grammatical functions; and (i) anaphora controlled functions.

These functions are also carefully identified in African languages, while the second segment provides linguistic evidence of some of these pragmatic functions. While exploring the pragmatic functions of African languages based on several scholarly opinions and definitions, among others, the text notes that the Association for the Development of Education in Africa (ADEA) considers that one of the basic pragmatic functions of African languages is to serve as a tool for education and sustainable development. It is also identified that African languages serve the pragmatic function of consolidating African identity and expelling the continent from the global margins. It also acknowledges and decries the death of African languages as a fast track to the loss of identity and culture of the African people and a force to successful external imperialism. In "A Motivational Treatise on Parenting," Bola Dauda noted that,

Language is critical not only for the survival of any culture but also for its revival. Language is the software for the storage, retrieval, processing, and use of culture. Any threat or danger to language spells doom to a culture and consequently to the essence and identity of a people. ... This trend of bringing up Africans without a mother tongue and without competence in any language is not only a danger to African culture but it is of a worrying concern. After all, without being proud to be African, we are paradoxically condemned to be second class citizens at home and abroad. And how can we develop our economy when we are not proud of our skin, language, food, clothes, and any homemade goods? How can we promote decency in relations, be it in politics or in business, that's, rule of law and fair trade, without a good mastery of language? How can we eradicate air and water-borne diseases, superstition, ignorance, and poverty without a language to promote public enlightenment? Language is critical to the future of African culture. And without being sexist or attempting to be pretentious, mothering, and if you want me to be politically correct, parenting, has a critical role in the child's language development and consequently in imbibing the African culture and identity."⁹

⁹ Bola Dauda, "A Motivational Treatise on Parenting." in *Gender, Sexuality, and Mothering in Africa*, eds. Toyin Falola and Bessie House-Soremekun. (Trenton: Africa World Press, 2011) 80-81.

However, Pratt *et al.* give credence to this deduction by stating that by undermining traditional languages, the roots of traditional education are gradually being uprooted.¹⁰ Also, as African society is characterized by multilingualism, the work contemplates this linguistic feature as either a bane or a blessing. The learning of multiple languages can be seen in different urban areas of Africa; this process assists daily interactions and is also mutually beneficial for the development of the continent. It will equally assist the exchange of goods and services as well as promote efficient collaboration between cultures.

To provide the mathematical evidence of the pragmatic function of African languages, this book indicates the invention of the Lebombo bone which is considered the most ancient mathematical tool; it is equally identified as a mathematical system that enabled humans in history to master time. To establish its connection to Africa, the work denotes that “the Lebombo bone is an exemplar of early Africans’ endeavor to develop a system on communication with a Pragmatic Function.”¹¹ Also to substantiate this claim, cited in the text, the *Encyclopedia of Science* states that, “It has been argued that since the Pragmatic Function of the Lebombo Bone was for lunar phase counting, then women must have been the first mathematicians, since keeping track of a menstrual cycle calls for a lunar calendar”.¹² The work also examines various languages from different parts of Africa so as to identify their different numerical systems that can serve as evidence to the mathematical efficiency or potential in those languages. The text examines the Mende language spoken by people in Sierra Leone and Liberia to reveal that the language exhibits “a numerical system based on the decimal structure as the Western system.”¹³ It also explores the variations in both systems to prove that, unlike the Western numerical system, the Mende people only count up to the number 19 and the language does not possess a word signifier for zero quantity. Also, the text further portrays that Africa has also had a huge impact on modern computing. It reveals that the ancient Kemetians/Egyptians invented the number zero (0) which has so far been the basis of the binary number system used for modern computing.

¹⁰ Yvonne Poitras Pratt, Dustin W. Louie, Aubrey Jean Hanson, and Jacqueline Ottmann, “Indigenous education and decolonization”, *Oxford Research Encyclopedia of Education* (2018): 1-32. https://www.researchgate.net/publication/322695370_Indigenous_education_and_decolonization

¹¹ Abdul Karim Bangura, *The African Mother Tongue and Mathematical Ideas*.

¹² *The Internet Encyclopedia of Science*, 2007:1.

¹³ *Ibid.*

As the work progresses, the sixth chapter examines the subject of interchangeability, which, as explained in the text, refers to the conveyance and reception of information through language by persons or groups of people. This is, however, due to the human ability to convey messages and information using gestures, spoken and written works and are also able to decode messages from others by mere looking, reading, or listening. The subject of interchangeability makes it possible to understand the reason for the human ability to receive information through language with no restrictions on the nature of the information they can give or hear and even read. However, just like the subsequent chapters, this chapter carries out this examination by exploring the linguistic and African linguistic expositions on the subject, as well as the African mathematical evidence with regard to the subject. To fully understand the linguistic expositions of the subject, the text analyzes the following themes; (1) synonymy, (2) complete feedback, (3) zoösemiotics or design features of animal communication, and (4) design feature of communication systems. These themes provide information on the various interactions necessary for interchangeability to occur linguistically.

In the exploration of the subject of interchangeability in African languages, the work implores the input of several scholars; one of whom is Cheikh Anta Diop. He discovered several writing systems of the indigenous African people, as well as how foreign writing systems have been able to develop orthographies for some of them, and how they can also be employed to create orthographies for others. For the text, this presents proof that interchangeability is a significant process of languages emanating from Africa. It also opines that interchangeability is most likely to occur with languages that are more closely related. It also goes ahead to analyze several African languages for the interactions of complex verbs as well as the discovery of ancient syllabic scripts, past tense verbs in the black English in South Africa, relative tenses of the isiZulu language in parts of Southern Africa, and so on. Deductions from these explorations provide incontestable proof that African languages are interchangeable and intersecting.

The work also reveals that for the African environment, the concept of interchangeability is also represented in the multilingual nature of the environment. Most African children acquire more than one language and tend to use these acquired languages interchangeably in society. It, therefore, advocates for the use of interchangeability in the teaching of African and European languages in education since it has been mastered so skillfully in other areas of life. This also, therefore, counters all claims that multilingualism cannot be achieved if African languages are opted to be used first in an education system. However, to provide mathematical evidence in connection to interchangeability, the work refers to the mathematical evidence inherent in the

combination of food prices like, say, 1 shilling and a wave of a hand to represent twenty cents from refugees from Rwanda. In other words, hand gestures are used in place of words, and they have mathematical representations. The work goes further to mention the concept across different discoveries and examples that prove the exchange of mathematical ideas between Africa and different parts of the world.

In chapter seven, the work examines the idea of cultural transmission as language design feature that proves that some aspects of language can only be learned by interactions with other users of the same language system. The linguistic discussion of the subject matter is subsumed in the following themes, which are elaborately and distinctly addressed for readers' clarity. They include the following: (1) evolution of human behavior, (2) cultural vocabulary, (3) cultural level of usage, (4) language transfer, (5) cultural variation, (6) cultural context, (7) cultural identity, and (8) cultural language styles.

Using various research reports from scholarly materials, the work proffers evidence that African languages have so far been a source of cultural transmission. This notion is however validated by de Voogt, who states that Africa has played a major role in the creation of writing systems, the writer reveals Egypt as the prime location for one of the earliest occurrences of writing.¹⁴ Drawing from a scholarly opinion, the text opines that by representing language in written form using scripts, an activity that is attributed to speakers of Afroasiatic languages, cultural beliefs, and practices were transmitted to different parts of the world. Assenting to this notion of cultural transmission, Emeka Nwobia is of the opinion that "language is the conduit for transmission of people's culture, norms, ideas, and belief."¹⁵ In other words, language is the storehouse of a people's identity and their ways of life and can, therefore, be an effective tool for the transmission of culture, ideas, and epistemologies of a given people. The work goes further to identify proofs of African linguistic-cultural transmission in different parts of Africa and beyond, while also identifying factors like the transatlantic slave trade as one of the most effective tools in the dispersal of African linguistic culture around the world.

To proffer evidence of cultural transmission of mathematical ideas, the book provides an array of examples that serve as evidence of cross-cultural transmission of mathematical ideas. The work makes reference to the transmission between the South of the African Sahara and North Africa, using

¹⁴ Alex de Voogt, "The cultural transmission of script in Africa: the presence of Syllabaries," *Scripta* 6 (2014): 121-137.

¹⁵ Ngozi U. Emeka-Nwobia, "The place of indigenous Nigerian languages in national development", *Research in Humanities and Social Sciences* 5, 12 (2015): 112-116.

the exchange of mathematical ideas. Central Sudan introduced mathematics in Kanem-Borno, which at the time was part of Islamic sciences. It was taught in secular and Muslim schools and also served purposes in the courts. Also, among many other pieces of evidence, scholarly opinions explored in the text reveals that the “geometric and hand-printed rock art in the Central Limpopo Basin located in Southern Africa” was not created in that location but is rather traced to “geometric hunter-gatherer rock art” of Central Africa.

In the eighth chapter, the subject of the arbitrariness of language is explored, and the text tries to underline the relationship between arbitrariness and African linguistic and mathematical ideas. Arbitrariness in this context is described as “the nonexistence of any tangible connection between gestures, actions, or sounds that are used to convey information and the distinct and independent things in the universe to which they allude.” The concept is considered a norm in human languages and asides from some onomatopoeic words; it is very predominant in human languages. However, like the previous chapters, this chapter is equally divided into three major sections that try to show the connection between arbitrariness and African linguistic and mathematic ideas.

Also, in chapter nine, the text analyzes the concept of discreteness in language, and like the other chapters, it proffers a connection between Discreteness and African linguistic and mathematical ideas. However, to better explain the concept, David Minger, cited in the text, describes the subject of discreteness “as a linguistic rendering which can be divided into small, distinct elements that can then be reconnected with other small, distinct elements to form novel linguistic renderings.” In other words, the notion of discreteness has to do with the human ability to fuse separate elements of language to expand the units of communication. To further buttress this notion, the book provides this example: “Add a plural morpheme to something like dog to get dogs [dagz].” It also goes further to explain that these units are not just restricted to morphemes but rather extends to phonetic elements as well as other elements of language. However, while trying to draw an African linguistic connection, the work provides evidence from parts of Africa that attest to the presence of discreteness in African languages. From Nigeria in west Africa, the text notes that the tones of Yoruba language exhibit features of discreteness. Also, by using factual illustrations from various parts of Africa, the present work provides evidence of discreteness in African mathematics.

Furthermore, the tenth chapter discusses displacement as one of the nine design features of language. As a concept, displacement is a language characteristic that explains the ability for people to discuss situation or persons that are spatially absent from the speaker. As an example, the text

identifies the discussions or talks of a supreme God like Allah, who the speaker has never met and who is not present at the moment of discussion. It also refers to times past as well as the distant future. However for the purpose of finding the linguistic expositions and the African linguistic and mathematical evidence of this language feature, the study goes further to explore the linguistic features of displacement extensively and they include the following identified features: (1) displaced modifiers and predication, (2) displaced speech, (3) displaced entities, (4) non-verbal systems, (5) phenomena included by Charles Francis Hockett, (6) evolution of language and cognition, and (7) communication. For lucidity, the perspectives of various scholars on these items are presented in the order they are listed here. The work also goes further to provide a synopsis of the research on displacement as it pertains to African languages and mathematics.

In the eleventh chapter, productivity is explored. In succinct terms, productivity refers to creativity with language; it shares a vague similarity with the earlier explored discreteness. However, as a distinct concept, it deals with language creativity, an example cited is the 'pluralization' of words in the English language. The mere addition of 's' to a word creates a new word. For clearer understanding, the view of Richard Nordquist is most appropriate for this explanation. He describes the concept as a "language feature that is employed to utter novel entities." For him, "Productivity is also recognized as "open-endedness" or "creativity"; it can also be viewed as being used to characterize certain "forms or constructions (such as affixes) that can be used to produce new instances of the same type." However, by employing several scholarly opinions and views the work presents evidence of the concept of Productivity in African languages while making a valid connection to African mathematical ideas.

The twelfth chapter, in many ways, underlines the basic ideology and background to this text, as it examines the role of mathematicians in the African renaissance. The work is of the opinion that mathematicians have played a crucial role in the development of Africa in ancient times. However, having recognized their contribution to the development of ancient Africa, the work makes relevant suggestions for a proposed collaboration between mathematicians and experts from other disciplines for an African renaissance. So far, the work has provided the necessary evidence to prove that African languages possess all the nine design features that will make the domestication of mathematics an easy task. The work also goes further to encourage the use of African languages in teaching so as to displace them from their perceived substandard status. It also advocates for further researches on the connection between language and the teaching of mathematics in Africa.

The thirteenth chapter, which is the final chapter of this exhaustive text, provides a general conclusion to the previous chapters explored. With the detailed information and opinions sampled, the work concludes that several factors influence the African mother tongue and mathematical ideas. It identifies the nine design features of language explored as core factors. It also establishes the need for African mathematicians to get involved in the struggle for African renaissance since it is obvious that they play a role in the entire process.

In all, this book has provided strong evidence that African languages possess nine design features that will make the domestication of mathematics an easy task. The book also goes further to encourage the use of African languages in teaching so as to recognize them for what they are and debunk the myth of perceiving them as substandard tools for educating African children. The book strongly advocates further research on the connection between language and the teaching of mathematics in Africa.

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List of Acronyms

ADEA	Association for the Development of Education in Africa
ADiMA	Association of African Didacticians of Mathematics
APMEP	French Association of Mathematics Teachers (Association Française des Professeurs de Mathématiques)
ATDM	Tunisian Association of Didactics of Mathematics (Association Tunisienne de Didactique des Mathématiques)
ATS	Auric Time Scale
ATSM	Tunisian Association of Mathematical Sciences (Association Tunisienne des Sciences Mathématiques)
AU	African Union
CFGs	Context-free Grammars
COCA	Corpus of Contemporary American English
COHA	Corpus of Historical American English
CSGs	Context-sensitive Grammars
CV	Consonant / Vowel
CVC	Consonant / Vowel / Consonant
CVCV	Consonant / Vowel / Consonant / Vowel
CVN	Consonant / Vowel / Nasal
CVV	Consonant / Vowel / Vowel
DDEs	Delay Differential Equations
ECSS	Elsewhere Condition Serial Search
EMF	Francophone Mathematical Space (Espace Mathématique Francophone)
ENS	Ecole Normale Supérieure
ESL	English as a Second Language
FSAs	Finite State Automata
FSTs	Finite State Tranducers
GESDI	Gross Environmental Sustainable Development Index
HHMs	Hidden Markov Models

ICT	Information and Communication Technology
LCA	Life Cycle Analysis
LNREs	Large Number of Rare Events
LTR	Low Tone Raising
MAA	Mathematical Association of America
MDC	Movement for Democratic Change
NCSU	North Carolina State University
NLP	Neuro-Linguistic Programming
ODEs	Ordinary Differential Equations
OEIS	On-line Encyclopedia of Integer Sequences
PBUH	Peace Be Upon Him
PM	Plural Marking
PR	Phonological Representation
P-rules	Phonological Rules
SIs	Semantic Interpretations
SMS	Short Message Service
SOV	Subject-Object-Verb
S-rules	Semantic Rules
SVO	Subject-Verb-Object
STEM	Science, Technology, Engineering, and Mathematics
SWT	<i>Subuhana Wa Ta'ala</i> (meaning in Arabic 'All Glory belongs to God; God is The Most Exalted and The Most High')
T-rules	Transformational Rules
UNIA	United Negro Improvement Association
URs	Unrestricted Rewriting Systems
USEPA	United States Environmental Protection Agency
ZANU-PF	Zimbabwe National Union-Patriotic Front
ZAPU	Zimbabwe African People's Union

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