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The Plausibility of a Postmodern Pedagogy of Mathematics in the African Context

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Abstract
In this paper, the author explores the possibilities of adopting a postmodern pedagogy of mathematics in the context of African culture and traditions that form part of the prevailing education systems. The author further examines the tenets of a postmodern pedagogy, paradigm shifts in education in Africa and questions Africa's readiness to adopt such a radical education philosophy.
The author takes a leaf from the pronouncements made in the Dakar framework for Action (2000) whose theme was "Education for All: Meeting our Collective Commitments", where six regional frameworks for action were developed including that of Africa. The frameworks made a robust analysis of the situation of education in Africa and warned countries against complacency in the development of educational strategies for the benefit of all learners.
The paper culminates in proposing ways in which Africa can respond in the face of unrelenting postmodern changes resulting from the loss of grip on the behaviours of individuals in contemporary African society due to globalisation. The author concludes that there is no hope in Africa engaging in postmodern pedagogical activities in mathematics classrooms at the moment due to insurmountable problems that the continent faces such as financial constraints, lack of political will and the scepticism on seemingly 'orderless' educational propositions.
Key words: postmodern pedagogy, mathematics education, outcome based education, education for all.

1. Introduction

Current belief posits that mathematics pedagogy must be grounded in the general premise that all students have the right to access education and that all students irrespective of age, gender, race and socio-economic status can develop positive mathematical identities and become powerful mathematical learners.
In light of this understanding, there have been efforts around the world towards the viability of moving from the traditional absolutist pedagogy to a more postmodernist (social constructivist) pedagogy of mathematics in view of calls to make education more inclusive and accessible to all. Education for All (EFA), an international initiative launched in Jomtien, Thailand, in 1990 to bring the benefits of education to "every citizen in every society" prompted governments to commit to achieve six specific education goals including "Improve all aspects of the quality of education and ensure the excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills".
This was reinforced by the development of Millennium Development Goals (MDGs) in 2000 which laid emphasis on the rights of children to access education and other social needs leading to a better life for all. This in turn led to many countries, including in Africa, making certain reforms in their education systems in response to these international calls. However, the majority of these reforms were a mere water-down of curricula which seem to have had a negative impact on the calibre of learners graduating from such curricula.

2. What are the tenets of a postmodern mathematics education?

Postmodernism is the philosophy which believes that truth does not exist or is unknowable and is relative to the culture. It is a radical scepticism and relativism that rejects any idea of truth, knowledge, reason, or objectivity and refuses even to aspire to such ideas on the ground that they are not only unattainable but undesirable, and that they are, by their very nature, authoritarian and oppressive.
What is true in a particular cultural context is therefore viewed to be not necessarily true for another as countries and cultures see things quite differently. Early twentieth century modernism was influenced by the theories of Sigmund Freud (1856 – 1939), arguing that human mind had a fundamental structure, and those of Ernst Mach (1838 – 1916), who developed a philosophy of science known as *positivism* which held that scientific laws were summaries of experimental events, constructed for human comprehension of complex data.

During the pre-modern era or the Enlightenment period, mathematics was presented as a natural science which, through exploring the natural fact multiplicity, established its definitions as abstraction from examples and validated its statements by testing deductions on examples. Then came modern mathematics, which through the invention of the set theory concept, turned Enlightenment mathematics upside down to become 'metamatics',

that by defining its concepts as examples of abstractions, and proving its statements as deductions from meta-physical axioms, needs no outside world and becomes entirely self-referring. Nonetheless, a self-referring mathematics soon became an impossible dream and this modern thinking led to modernisation, which ushered in some alternatives such as the rejection of superstition in favour of rationality, supernatural in favour of nature, and religious authority in favour of logic and the scientific method. The Modernist point of view of mathematics is promoted by the absolutist schools of philosophy of mathematics, namely, logicism, formalism, intuitionism, and mathematical realism (Platonism). Specifically, modernism emphasised that mathematics is static, infallible, indubitable, abstract, eternal, perfect, certain, precise and an absolute tool for exploring what constitutes the nature of something.

In the era of modern thinking life was seen as structured, ordered and hierarchical, and deductive, scientific thought prevailed. Modern students rely on this kind of logic, on dogma and on learning what they are told because it is in the best interest of society. This resonates well with the cultural and traditional mores of modern Africa where children tended to listen to their parents and other older members of society and followed instructions with loyalty and respect. Society had a grip on the behaviours of its members and made choiceful decisions on behalf of its younger generation. With reference to schooling, modern educational theory classifies and segments learning, takes the world apart, splits it into disciplines, objectifies, quantifies and repackages it as courses with learner objectives. This model relies on "the sage on the stage" to parcel out the information to learners who are expected to use other strategies to improve learning. A grade is assigned based on the degree to which the learner has achieved these teacher-determined objectives. The essence of this model is to pit learners against each other in order to see who proceeds to higher echelons of the education system.

Postmodernism originally began as a reaction to modernism, in particular to the pursuit of perfection and harmony of form and functionality of modernist architecture (Bertens 1995). In its most general sense, the term now evokes a cultural, intellectual, and artistic outlook that rejects any central hierarchy or organizing principle and embodies complexity, ambiguity, interconnectedness, and contradiction. The basic methodology of postmodernism is *deconstruction*, a term introduced by Jacques Derrida in the 1960s which involves the close reading of texts to demonstrate that rather than being a unified whole, any given text has irreconcilably contradictory meanings.

The postmodernist point of view of mathematics deconstructs absolutism and deems certainty to be an unattainable idea. Mathematics is viewed as a fallible and corrigible discipline that is subject to constant change. In this view, a mathematical truth is never absolute but is to be interpreted relative to a background and like all other scientific entities; mathematical objects arise from the needs of human societies. Mathematical proofs depend on a set of axioms assumed to be self-evident and true by human beings, and hence are subjective and time dependent (Lakatos 1976). Mathematical knowledge is a representation which is no more or no less true than any other representation whose concepts, theories, and methods are socially constructed and hence mathematics is a dynamic endeavour (Ernest 1991).

Postmodern learners are required to develop literacy skills and the awareness of their own selection bias since information has become abundant, free and accessible. Within this democratised society of digital interactivity, the postmodern teacher or instructor must be able to walk with their students through the data and information to the knowledge that is both involved with the purposes of the course of studies and with the meaning relative to the life of each individual student. This follows a critical pedagogy, which is not a one-size-fits-all, but rather a humanising pedagogy that values students' (and teachers') background knowledge, culture, and lived experiences (Bartolomé, 1996), moving students (and teachers) into their own ever-expanding interpretations of their lived worlds (Greene, 1996).

It is important to argue, therefore, that postmodern life is not just about rapid and turbulent change, but also about fragmentation of old systems and expectations. In the postmodern era, society has lost grip on the behaviour of its younger generation, who defend this loss by laying claim to their individual rights. To deal with the fragmentation of the old paradigm, postmodern students apply their own story and experience to the learning environment. They learn to trust not only their own rational processes, but also their exceptionally gifted intuition (Lehrer, 2009). The postmodern instructor engaged with the learner from an appreciative perspective encourages this person to relate to the directions of the course or programme to their personal experiences, instead of viewing this as past baggage that should be left outside the educational experience. In this sense, the instructor or tutor and student, co-create new learning and understanding in the moment.

Postmodern learning is therefore a creative act which involves ever-changing environments and learning arrangements whereby individual plans can be created wherein the learner is an active participant. The postmodern teacher and student are partners in learning a body of knowledge within a contemporary context without discarding other methods, but using, modifying and recreating them to suit the situation at hand. The instructor is a "guide on the side" whose role is to facilitate learning experiences toward meaningful aims. Alternate views and content integration are encouraged and ideas are brought together through a holistic

approach to form new ways of knowing the world. New learning relationships and knowledge creation potential are heightened and become an exciting aspect of the postmodern class.

3. Paradigm shifts in Education in Africa

Historically, formal education in Africa was introduced as a result of colonisation by Western countries. Even in parts of the continent where colonisation had little influence, European missionaries were the architects of educational change paradigms. The traditional school was replaced by formal curricula with English, Portuguese, Dutch and French dominating the education ethos in accordance with the colony statuses of the respective African states. Mathematics and the Natural Sciences were introduced to replace traditional ethnomathematics and indigenous scientific knowledge which were relegated as ineffectual and of no consequence in the modernised Western world order.

For instance, there was the segregated (apartheid) education system in South Africa, where blacks were given Bantu education which was inferior to that provided for those privileged members of European origin. We trace the imposition of European languages in all of Africa where such languages continue to dominate both the education systems as well as the socio-economic infrastructures of different countries. In some parts of Africa the only language accessible to society is that of the Europeans wherein their own indigenous language has become foreign or even defunct. This has also meant that European languages became prominent in driving the education systems of most African countries as the majority of subjects are now accessible through these languages.

Postmodern theorists believe that most constructs, that is, images or ideas that people formulate in order to understand the world, are devised by those in power, especially white males, in order to maintain dominance over females and other racial groups. This view, which is also a tenet of Marxism, is the reason why postmodernists seek to "deconstruct" all knowledge in order to eliminate the constructs of those in power and replace them with new ones developed by the exploited masses.

In the recent past, there have been curriculum reviews that endeavoured to shift from the European models in favour of African cultural beliefs, famously referred to as "localisation" of educational ideals. Policy development in these contexts has been guided by the universal principles of a human right to basic education, equality and the recognition of the democratic rights of parents, teachers and all learners, including those with disabilities. But the truth is that the European models of education remain entrenched in the African continent due to the stranglehold they continue to impose on the latter through language, economic dominance and technological influence.

It is not surprising that, to function well in the current global village, one has to be adept with "international languages" such as English and French. The shift to localisation has therefore been merely to take cognisance of the prevailing socio-economic contexts which are obviously tainted with Western cultural values. Globalisation has a tendency to appeal to most of us as ushering in new and innovative ways of living and yet it also continues the subtle domination of the developing countries by the developed world. African nations therefore need to embrace globalisation and the fast growing technologically driven economic wave with a lot of caution.

4. Is Africa ready for a postmodern pedagogy of mathematics education?

As the Dakar Framework for Action (2000:13) articulates, South Asia and sub-Saharan Africa, where progress has been most difficult to achieve, clearly presents a much deeper challenge than world averages imply and will require particular attention if goals of Education for All are to be reached in each and every country. This can also be said about the impact of postmodernism in these parts of the world.

Postmodernism has had a huge impact on the field of mathematics outside Africa. The new math (also called "integrated math", "fuzzy math", "constructivist math", "Chicago math", and "Every Day math", which is based on postmodern ideology, is reportedly taught to a sizable number of K-12 students in the US even though it is well known that integrated math is decidedly inferior to traditional math, such as Saxon math and Singapore math. Again, in the United States of America, in the history textbook called "*We The People: the Citizen And The Constitution"* (authorised and funded in federal law HR6, 1994, and re-authorised and funded in 'No Child left Behind, 2002') the writers say:

> As fundamental and lasting as its guarantees have been, the US Bill of Rights is a document of the eighteenth century, reflecting the issues and concerns of the age in which it was written. … Other national guarantees of rights also reflect the cultures that created them. Many of these cultures have values and priorities different from our own. In many Asian countries, for example, the rights of the individuals are secondary to the interests of the whole community. Islamic countries take their code of laws from the teaching of the Koran, the book of sacred writings accepted by Muslims as revelations to the prophet Mohammad by God. (P. 207).

The above is a postmodern ideology where students are being taught that the fundamental principles of the US are mere constructs created by culture and are not really true or genuine. "Truth" is a concept that transcends nature and for the postmodernist, therefore, cannot exist.

A postmodernist approach to pedagogy of mathematics emphasizes experimental mathematics, in congruence with the fallible and quasi-empirical nature of mathematics. This calls for topics that are not introduced at an early stage in a modernist pedagogy such as examples involving nonlinear systems, those leading to fractals and chaos theory, and those that are relevant to naturally occurring discontinuous phenomena, to be made a part of the curriculum at an early stage.

Since postmodern epistemology measures knowledge on its utility and functionality, the use of computers in discovery and proof of mathematical ideas should be encouraged. It may be true that computational proofs imply a probability but not the certainty of a mathematical result, but based on the above criterion, these are just as valid as the classical axiom-definition-conjecture-proof technique. Teachers of mathematics should emphasize intuitive explanations and alternate solution methods. To show the dynamic character of mathematics, topics such as non-Euclidean geometries should be standard parts of the mathematical discourse. One of the most significant contributions of the postmodernist approach to pedagogy of mathematics would be the rejection of the 'Aristotelian Law of The Excluded Middle' that something is either true or false, and to replace it by fuzzy logic based on "degrees of truth" or perspectives. The question then follows: "Is Africa ready to engage in such a radical pedagogy of mathematics education?"

If I were to respond to the question posed in a nutshell I would say "No" and there are a number of reasons for this response. First, most of Africa is still inundated with the effects of colonisation in education, from which it will never completely escape. The foreign languages issue that I have alluded to continues to be a driving force in the education systems' selection strategies for further studies.

Second, the teacher education institutions in African countries are not ready for a radical shift from the traditional absolutist teaching/learning paradigm. This is because absolutism has served them well and in line with the prevailing political beliefs. The modern African societies define individuals' identities through the functions they choose to serve and, although there are choices about which role the individual shall adopt, there is little choice concerning how that role will be played out in society. African societies are still trapped in the concern for right and wrong thinking and with maintaining a certain distance and staying in one's role. The individual's chosen role determines who they are, what they value and what defines their purpose.

The individual's identity is therefore defined by, and relies on, the external judgement of one's organisation and society. Consequently, in learning there are comparable right or wrong answers and the roles of the teacher and learner are clearly defined. The teacher is the censor through which 'right learning' is validated (Reigeluth and Avers, 1997). The 'sage on the stage' metaphor applies in African mathematics classrooms where 'the teacher knows all' and the learner follows instructions almost in verbatim. In these classroom discourses, the teacher has authority over what is being said and discursively determines the learning route. The student in the majority of cases is like a non-complaining passenger, who curiously watches as the driver (teacher) veers the locomotive (learning environment/activities) as s/he wishes.

Third, the dire financial constraints that most of Africa finds itself in as well as the unfair distribution of budgets to education, curtail any change that might upset the status quo. This, coupled with the fact that 'change' is never a readily acceptable concept due to 'fear of the unknown, makes it difficult to see Africa's readiness to embrace the postmodernist paradigm.

The Dakar Framework for Action (2000:14) warns: "Ensuring that Education for All is provided with adequate, equitable and sustainable resources is the foremost challenge. Many governments do not give education sufficient priority in their national budgets. Too many do not use resources for education effectively and efficiently, and often subsidise better-off groups at the expense of the poor".

Moreover, the postmodern pedagogy, where the roles of the teacher and learner, although differentiated, are not discreet, does not settle well with African traditions and beliefs where the elder's voice takes precedence. An education system which intends to disrupt established values is most likely to be unwelcome. The African states and their reliance on the development and maintenance of hierarchies, which form part of the political and academic establishments tend to resist any proposal to finance seemingly 'orderless' education structures.

It is therefore improbable that Africa can be viewed as being ready for the postmodern pedagogy of mathematics education in the present. Nevertheless, there have been some acceptances of certain aspects of the postmodern paradigm in parts of Africa. The emergence of Outcome Based Education (OBE) in South Africa around 1997 was a postmodern gamble. The collapse of the system in 2010 goes to show the lack of readiness that I have alluded to. The pronouncements of moving towards a learner-centred education system in Botswana which we find in recent syllabuses can also be viewed through a postmodern lens. However, some tenets of postmodern thought such as "discovery learning", creative spelling", and an over-emphasis on group projects and other social settings are not visible in our mathematics classrooms.

Despite Africa being resistive to the postmodern pedagogy of mathematics education, there are some inroads in embracing some of its tenets. But the road seems thorny considering the lack of resources and well trained personnel to embark on a radical postmodern education project. This has not completely discouraged many in Africa who see this new mode of learning as the only hope for their children's future.

5. How can Africa respond to render mathematics education meaningful in the postmodern era?

The Dakar framework for Action (2000:30) stipulates that: "Urgent attention shall be devoted to the development of materials, methodologies and social learning environments that are feasible and sustainable in the local environment and relevant to the African learner. … We shall develop a learning environment that is safe and intellectually stimulating and pedagogically based on learner-centred approach and democratic values and practices in the teaching-learning interaction".

In view of the international calls such as EFA and the MDGs, Africa needs to open up to make mathematics education more inclusive. The postmodern philosophy, by positing 'truth' to be universal and relative, and believing in 'perspectives', 'constructs' or 'point of view' in describing how various groups see the world, is trying to level the education playground so that it becomes more accommodative and accessible to all.

It is in the spirit of promoting EFA and MDGs that African states need to be more responsive to some of the concepts advocated for by postmodernism without discarding the traditional philosophies that they are currently grounded upon. We see aspects of the postmodern movement in most of today's real-life events. Even the mathematics that has so far been viewed to possess 'truth', 'supreme beauty – cold and austere, without appeal to any part of our weaker nature', even it, has lost that appeal to the present day learner. This is because mathematical knowledge is now taught and learnt, not because of its 'reality' and 'truthfulness', but because of its 'usefulness'. In Botswana for instance, every learner is required to learn mathematics from lower primary to upper secondary level. The understanding is that each learner will meet some usage of mathematics in real-life regardless of where the education system may take them, and this has become a trend in most of Africa.

The application of mathematics to all fields of study and in particular to technology, which is instrumental in economic development, has led to this understanding. It is therefore imperative upon Africa to find ways of accommodating aspects of the postmodern pedagogy in mathematics education in a bid to bring all learners to appreciate the role of mathematics in social life. Today's learner is more versatile given the availability of information in all its formats (print media, audio, visual, the internet, etc.). The education system needs to harness such information in ways that the present learner can appreciate and gain new knowledge.

The Dakar framework for Action (2000:34) emphasises: "Education shall be the strategic medium for attaining African Renaissance in the globalised economy, culture and communication in the twenty-first century". This calls for embracing other forms of strategies in didactics to augment prevailing traditional absolutist mathematical teaching and learning methods, and that is where postmodern pedagogy should be considered a viable choice.

6. Concluding remarks

In this paper, I endeavoured to argue whether a postmodern pedagogy of mathematics is viable in an African context. I have concluded that Africa is not ready for this type of pedagogy given the political and cultural traditions that still influence its education systems.

I have also argued that regardless of Africa's acceptance of EFAs and MDGs, its loss of grip on the behaviours of its younger generations, and its move towards localisation of curricula, there are no prospects for a radical shift towards a social constructivist pedagogy that postmodernism refers to. Notwithstanding, some aspects of the postmodern paradigm can be adopted and appropriately used in conjunction with traditional methodologies to enhance the teaching and learning of mathematics in Africa, in a bid to take today's information-loaded learner on board and to promote the knowledge-economy that most African states aspire to achieve..

The failure of postmodern pedagogies, such as OBE in South Africa, was mainly due to lack of trained personnel and material resources, that this model requires, coupled with the sceptical view that sees this form of education as the dilution of educational standards. There is a strong voice against learners shaping their own trajectories as directed by the postmodern paradigm. There is also mistrust as to whether it is possible for a learner to go through a learning process that is not dictated by educational norms which pit individuals against others.

One can conclude therefore, that, in the face of strong criticisms against the postmodern pedagogy, the lack of resources, both material and personnel, and the lack of political will to venture into unknown educational traditions such as espoused by the postmodern paradigm, this form of teaching mathematics is not feasible in African contexts, at least for now. Despite the rhetoric with which many African countries have endeavoured to advance some tenets of postmodernism, the likelihood of realising their wishes is still far-fetched.

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