International Journal of Science Education

ISSN: 0950-0693 (Print) 1464-5289 (Online) Journal homepage: http://www.tandfonline.com/loi/tsed20

# An Examination of the Influence of Globalisation on Science Education in Anglophone Sub-Saharan Africa

Anthony T. Koosimile & Shanah M. Suping

**To cite this article:** Anthony T. Koosimile & Shanah M. Suping (2015) An Examination of the Influence of Globalisation on Science Education in Anglophone Sub-Saharan Africa, International Journal of Science Education, 37:14, 2358-2385, DOI: 10.1080/09500693.2015.1079667

**To link to this article:** http://dx.doi.org/10.1080/09500693.2015.1079667

Published online: 18 Sep 2015.

*International Journal of Science Education*, 2015
Vol. 37, No. 14, 2358–2385, http://dx.doi.org/10.1080/09500693.2015.1079667



# An Examination of the Influence of Globalisation on Science Education in Anglophone Sub-Saharan Africa

Anthony T. Koosimile* and Shanah M. Suping
*Department of Mathematics & Science Education, University of Botswana, Gaborone, Botswana*



This paper takes the view that the emergence of some trends and practices in science education mirrors the influence of the process of globalisation in Anglophone Sub-Saharan Africa. Through a literature review, an attempt is made to link science education and globalisation by answering the question: 'What influence does globalisation have on science education in countries in Anglophone Sub-Saharan Africa?' The findings of the study show some significant convergence of what is valued in science education in Sub-Saharan Africa in areas such as pedagogy; English language as a medium of instruction; assessment of learning; mobility of students in the region; and in the frameworks for collaborative engagements among stakeholders in Sub-Saharan Africa. The paper concludes with a reflective end-piece calling for more case studies to help scrutinise further the influence of globalisation on science education in Sub-Saharan Africa.

Keywords: *Aid Agencies; Commodification; English language; Globalisation; Influence; Internationalisation; Knowledge-based society; Knowledge economy; Sub-Saharan Africa; Science education*

## Introduction

The Sub-Saharan Africa region comprises 45 countries in total and, according to the World Bank, around 34 of the world's 48 poorest countries are in Africa. For example, according to Chandy (n.d.), the year 2015 marks the 20th year of faster economic growth in the region, averaging 5.2% annually, yet with the number of people living under US$1.25 a day increasing from 358 million in 1996 to 415 million in 2011. Furthermore, UNESCO's Education for All Global Monitoring Report of 2005

*Corresponding author. Anthony T. Koosimile, Department of Mathematics & Science Education, University of Botswana, Gaborone, Botswana. Email: koosimil@mopipi.ub.bw

states that the Sub-Saharan Africa region is characterised by massive educational deprivation. However, of Sub-Saharan Africa's roughly 600 million inhabitants, around 88 million are of general secondary school age (Bregman & Bryner, 2003); nearly all of them are exposed to some form of school curriculum with a science education component. Science education here means not only the school curriculum (i.e. official curriculum and curriculum-in-action), but also everything else (the policies, politics, resources, and structures) that go into shaping its existence and its reality as a discipline in education. Interestingly, the field of science education has been developing for over half a century, flourishing over the past few decades (Fraser & Tobin, 1998) in response to a variety of pressures and practices impinging on education across the world. For example, 'the globalized nature of modern society has generated a number of pressures that impact internationally on countries' policies and practices of science education' (Fensham, 2011, p. 698). Likewise, education in all its shapes, forms, and scope, at whatever level, as a multifaceted enterprise in a globalised social, cultural, political, and economic milieu, has also invariably been thrust into a world-wide domain where its nature is a subject of interest and debate.

Currently, the concept globalisation is widely studied in the literature mainly through the neoliberal, radical, and transformationalist perspectives (Burton, 2014). Neoliberalism, as the currently dominant political-economic ideology worldwide (Ball, 2012; Verger, 2014) is identified with and equated to a 'smaller and more limited role for the state and the greater use of the market and the private sector in public services' (Burton, 2014, p. 322) including in education policy and practices within and across countries. However, as noted by Patrick (2013), neoliberalism as practice, theory, and praxis is dynamic and has transformed from being a hegemonic set of discourses and practices to a point where it has achieved the status of doxa. Also, 'neoliberalism as a globalised ideology interacts with construct of knowledge economy to give rise to specific conceptualisations of educational outcomes and aims' (Patrick, 2013). For instance, within the now pervasive framework of knowledge-based economy (Ball, 2001; Coll & Taylor, 2008; Ozga, Seddon, & Popkewitz, 2006), educational institutions are turned into sites for promoting and imparting virtues or attributes deemed necessary for citizens of the global village in the twenty-first century—the attendant global issues and concerns of educational development, educational quality, and access are addressed through adoption of 'market' solutions (Ball, 2012). The key thrust in education focuses predominantly on enhancing the citizens' preparation for and contribution to society from a broad, long-term perspective (Çelik & Gömleksiz, 2000). Such attributes, which have now been infused by various means into schools include skills, attitudes, values, beliefs, expectations, conventional actions, materials, artefacts, technological knowhow, and world-view (Cobern & Aikenhead, 1998). In line with this view, as Evans, Rich, Allwood, and Davies (2008) assert, 'schools within a "knowledge economy" nurture and endorse "corporeal orientations", that is to say, ascribe value, meaning and potential to "the body" (particular bodies) in time, place, and space … these processes celebrate particular virtues' (p. 387).

In this milieu, science and science education are seen as cultural enterprises that form part of the wider cultural matrix of society (Maddock, 1981); the key aim of

teaching science is viewed in globalised contexts as enculturation into behaving according to some dominant cultural norms and conventions, especially the way in which the wider society makes sense of the world (Cobern & Aikenhead, 1998). Foucault (1984) conceptualises these complex patterns of intertwining of knowledge (science/reason), governance, and disciplinary control as biopower,

> a coherent and powerful technology, … [that] refers to the increasing ordering and regulation of all realms of society by the state under the guise of improving the welfare of individuals, not as individuals as such, but rather as subjects of a population. (Olssen, 2004a, p. 67)

Foucault also uses the concept biopolitics to suggest the general social and political power over life that results from, among others, the aims, goals, nature, and quality of education in twenty-first century—that is, the calculative governmentality for future population knowledge, management, and control (O'Neill, 2015): 'Western man gradually learns what it means to be a living species in a living world, to have a body, conditions of existence, probabilities of life, an individual and collective welfare, forces that could be modified … ' (Foucault, 1984; p. 264 cited by Lazzarato, 2002, p. 1) However, the idea in this article is not to adopt neoliberalism and Foucault's concepts of biopower and biopolitics as theoretical frameworks for the study, but the point here is that globalisation is broad and can be seen from many perspectives and philosophical inclinations.

Consequently, our goal in this article is to provide insights into how the process of globalisation has influenced the emergence of certain trends, activities, interaction, ideas, pedagogic assumptions, and collaboration in the field of science education within and among countries in Anglophone Sub-Saharan countries. *Influence* in the context of this paper is defined purposefully as the implications for science education in general when the latter makes contact with, or is driven by, globalisation as a process, practice, theory, and praxis. The study, through a literature review, focuses on making the emergent themes evident as they constitute shared cross-cultural values or cross-border themes indicative of the influence of globalisation in science education (Kluver & Fu, 2004). Globalisation is seen widely in literature (e.g. Liu, 2012) as a force driving the increased levels of integration or interdependence of ideas, themes, and peoples in education across continents.

The paper starts with an overview of the concept of globalisation in relation to science education, before focusing on some methodological considerations that underpin this work. The presentation of the study's findings revolves around showing the interconnectedness or otherwise of certain themes over vast distances across Sub-Saharan Africa; this provides a geographically broader focus. However, the idea is not to generalise across disparate environments or to gloss over the very important practices and nuances that prevail on the ground in different countries on the basis of what is, or appears to be, some convergence of educational rhetoric or practice. The work terminates with some reflective comments that seek to inspire and stimulate more research into the influence of globalisation on science education in Sub-Saharan Africa, or indeed elsewhere.

## Context: Perspectives on Globalisation and Science Education

According to Al'Abri (2011), 'globalisation' is a broad and ambiguous concept that has found wider use and application in education. Diverse definitions are found in the literature. See for instance Altbach (2004), Barnard and Burgess (1996), Carter (2005), Giddens (2003), Inda and Rosaldo (2008), and Lewin and Dunne (2000). In this work however, globalisation is viewed as 'the increasing tendency for the globe (*Sub-Saharan Africa*) to constitute the effective domain of action and of thinking, in relation to a specific issue' (Kress, 1996, p. 186). The issue in this context is science education with respect to how it evolves in Sub-Saharan Africa in response to pressures of a global nature. Carter (2005) portrays 'the very nature of globalisation itself as simultaneously able to manoeuvre between/within/around, colonizing all contexts, and consummate at creating the conditions for its own success' (p. 575). Clearly,

> where the present case of globalisation is, perhaps, different from everything that preceded it, is the interconnectedness of its political, economic, cultural, educational and technological agenda, complemented by the intensity of its omnipresence all over the world, as measured by the speed (via current technological innovations) with which its diverse components can affect people's lives with similar reactions and concomitant sometimes enfranchising, and more often disenfranchising, livelihood results. (Abdi, 2006, p. 20)

Thus, globalisation in the contemporary world is considered a major factor in stimulating change and in legitimising the perceived and real transformative power of education when it aligns with the needs and demands of modern societies. However, perhaps owing to its perceived omnipotence, and due to the lack of clear policy initiatives to define and guide globalisation in Sub-Saharan Africa, the concept has been viewed with some consternation and ambivalence by some in the region. For instance, according to Bregman and Armstrong (2004), participants at a conference on science education in Uganda in 2003 were divided, or rather unsure, about the extent to which globalisation was a viable framework for their deliberations. Green, Little, Kamat, Oketch, and Vickers (2007) also echo similar sentiments, and note that 'globalisation has not been perceived positively in Kenya, partly because it is associated with the Structural Adjustment Programme (SAP) implemented by the Kenyan Government since 1990 on the recommendation of the World Bank and IMF' (p. xiii). Thus, as observed by Burton (2014), globalisation can be understood in three ways—'as benign, negative or somewhere in between' (p. 317).

However, while 'globalisation is indeed implicated in the discourses of science education, even if it remains under-acknowledged and under-theorized' (Carter, 2005, p. 561), the relationship between globalisation and science education is rather tenuous and uncertain. But, Zahra (2013) posits that modern science education has ontologically, epistemologically, and methodologically imbricated with neoliberalism. Hence, as Vavrus (2009) notes,—the current thinking in education in globalised contexts suggests that improving the quality of science education is an economic imperative for developing nations, in an era when knowledge is a vital form of capital, or an international commodity in the knowledge society (Al'Abri, 2011). Consequently, quality education is now regarded as one of the main components in poverty alleviation

and occupational growth (Vaggi, Ventura, & Viezzoli, 2003), and in the political democratisation of education in the contemporary world (Kamens & Mcneely, 2010). Carter (2005) elaborates on this point:

> It is increasingly clear that contemporary education, including science education, needs to be considered in tandem with globalisation as the dominant logic at work, rethinking and reconfiguring the social and cultural landscape in which it is embedded. Globalisation and education become mutually implicative categories with knowledge globalisation's fundamental resource, and education as a major player in its production, rationalization, distribution, and transmission. (p. 562)

But,

> Science education works somewhere in the spaces between globally influenced nation-state policy production, and local sites of practice, strongly influenced by traditional trajectories of science education. Consequently, there is a naturalization of globalisation's shaping forces, influencing and changing science education in ways that remain largely under-acknowledged and opaque. (Carter, 2005, p. 573)

In fact, there is evidence that suggests that research tends to emphasise the significance of how the relatively permanent features of the education environment function as a buffer to or contribute to reform initiatives in science education in Sub-Saharan Africa. And, there is relatively little acknowledgement of globalisation as a framework for understanding the various aspects of the reforms, except perhaps in the context of discussions regarding the involvement of aid agencies in education in developing countries (see, for instance, Abdi, 2006: Tabulawa, 2003).

Apparently, the involvement of aid agencies in science education in Africa drives a neoliberal agenda that has always resulted in curricula (i.e. content, philosophical assumptions, pedagogy, and the like) mimicking those in developed countries. For instance, in the 1980s science education consolidated in many industrialised countries (Lewin, 1990) in which the changes in educational systems aligned with the then dominant thinking in educational circles of the OECD (Organisation for Economic Cooperation and Development) countries and the World Bank. The changes marked a distinct shift from the manpower planning perspective, so dominant since the 1960s, to the human capital theory (Kahn, 1989); the change had a significant bearing on the nature, scope, and underlying themes in science curricula in many developing countries (Kahn, 1989). Some of these changes can be understood within the context of 'modernisation theory', in which education was seen as key to unlocking the door to modernisation and creating modern individuals (Robertson et al., 2007). The dependency theory, which emerged in the 1960s, challenged modernisation theory as a means through which developed countries (i.e. the centre) exercised control over less developed countries (i.e. the periphery) (Robertson et al., 2007).

But the typical curricular reforms followed a somewhat 'incremental development designed to build on past experience, locally or internationally' (Coll & Taylor, 2008, p. 356) (see also, Lewin & Dunne, 2000; Ogunniyi, 2007) 'without questioning very deeply the aims, the dominant views of the nature of the scientific knowledge and the prevalent conventional wisdom of the teaching methods' (Lewin, 1990, p. 4).

Science too arguably 'reflects the norms of a liberal western sub-culture and represents a process of westernisation' (Altinyelken, 2010, p.155) such that western science 'presents itself as an imperative and superior way of knowing' (Malcom, 2002, p. 228) (see also, Kamens & McNeely, 2010). However, studies in Ethiopia, Botswana, Kenya, Tanzania, Gambia, and South Africa, among others, tend to confirm what happens wherever child-centred, active pedagogy, cooperative learning, and the development of critical thinking and problem-solving skills are embraced without question (Altinyelken, 2010). The general conclusion reached on such failures is that 'there was little or no suggestion that there might be "cultural" difficulties in using material originally from an entirely different context' (Lillis & Lowe, 1982, p. 172) (cf. Ingle & Turner, 1981; Waast & Krishna, 2003). Some recent attempts at integrating the indigenous knowledge system into the curriculum in South Africa (Ogunniyi, 2007) and other countries (Quigley, 2009) provide some hope that science education will one day embed into the wider operative cultural contexts of schools.

There are, however, other challenges in science education that need addressing in Sub-Saharan Africa in general. One such challenge is the seemingly entrenched traditional and prescriptive instructional behaviour in schools, with pedagogical practices generally described as authoritarian, teacher-dominated, and lecture-driven (Altinyelken, 2010; Jegede, 1995). These have proved recalcitrant to change despite a sustained history of progressive curricular reforms in science education in Africa. Furthermore, the existence of a gap between what students need to know (ideal curriculum) and what the curriculum promotes in schools (experiential curriculum) if they (students) are to contribute to the promotion of the social and economic growth in their countries is yet another challenge (Bregman & Armstrong, 2004). Other issues, such as a lack of quality instructional materials (e.g. textbooks), lack of laboratory accommodation, unqualified teachers, and poor work conditions are ubiquitous in the literature. Some dissenting voices would argue that although there seems to be some considerable convergence and hegemony in science education in Sub-Saharan Africa (Kamens & McNeely, 2010), it cannot be claimed that the schemes in different countries follow identical policies and practices (cf. McGrath et al., 2006). Thus 'as long as the process of customisation is hard at work, the spectre of homogenisation will be kept somewhat at bay and the world will remain full of difference' (Inda & Rosaldo, 2008, p. 20). According to Verger (2014), this has important methodological implications:

> Taking ideas more seriously implies having to pay more attention to the carriers of these ideas, and tracking the policy networks they constitute … It also implies having a better understanding of how policy entrepreneurs introduce new policy ideas in global education agendas, and frame and disseminate them across different fields, organizations, and regions … It also requires us to have in-depth knowledge of the particular contexts in which these ideas are being adopted, as a way to capture how multiple contextual contingencies operate in a strategically selective way by favouring certain actors, ideas, and discourses over others.

It is in this context that the broad question guiding this paper reads: 'What influence does globalisation have on science education in countries in Anglophone Sub-Saharan

Africa?' This leads to two interconnected questions that narrow the scope of the paper: 'What patterns, trends or themes in the literature emerge on the influence of globalisation in science education in Anglophone Sub-Saharan Africa?' and 'What implications and/or outcomes do they have for science education in Anglophone Sub-Saharan Africa?'

In responding to these questions in the context of Sub-Saharan Africa, the idea is not to remove issues from the global agenda and confine them to a particular location; rather, the main concern is to show some continuity in the dissemination of some contemporary thought and significant action as driven by globalisation.

## Methodological Considerations

The primary source of information in the study is a literature review (Merriam, 1988; Wiersma, 1986). The objectives of this review were to identify existing knowledge of the influence of globalisation in science education in Sub-Saharan Africa; identify emergent themes on the relationship between globalisation and science education (cf. Carter, 2005); identify gaps in research (Marshall & Rossman, 1999); and to analyse the data for evidence that can provide insights into the outcomes of what happens at the confluence of science education and globalisation. The literature reviewed is mainly peer-reviewed journal articles, published large-scale case studies, and various online sources from the 1970s to the present which make reference to globalisation, curricular reforms, education, and science education in Sub-Saharan Africa. Hence, in reviewing the literature,

> … we *(too)* are convinced that globalisation involves 'new' phenomena as well as (involving) continuities with the past. It is a discourse that is anchored in the material world, it has real material effects, and involves shifts in how we see and explain the world. A key element of globalisation is the thickening of multilateral interactions and interconnections in the global governance landscape. (Robertson et al., 2007, p. xii) *(the italicised words are ours)*

However, the general dearth of case studies and baseline data on the majority of curricular initiatives (Hardman, Ackers, Abrishamian, & O'Sullivan, 2011) as well as the lack of overt acknowledgement of relationships between science education and globalisation (Carter, 2005) in individual countries in Sub-Saharan Africa mean the data or evidence in this paper serve, in most cases, a limited but important purpose: they may not provide *definitive proof* of the influence of globalisation on science education, but they provide *supporting evidence* of the same. This means that the qualitative chain of evidence in the study may not be strictly robust *per se*, but it remains relevant for establishing a baseline in terms of the picture that emerges on the influence of globalisation on science education in Sub-Saharan Africa.

Furthermore, the literature review takes place also against a backdrop of concerns over the nature and epistemology of globalisation, which is deemed contentious and nebulous (Brennan, Enders, Valimaa, Musselin, & Teichler, 2008; Dreher, Gaston, Martens, & Van Boxem, 2010). There are no specific standards for benchmarking any aspect of globalisation (Bhandari & Heshmati, 2005). As noted,

> … the epistemology of globalisation makes one doubt the possibility of measuring it. Globalisation occurs at level that make measurement difficult, e.g., trans-border environmental issues, cultural transformations and a so-called 'global consciousness' … the 'qualitative' side of research generally focuses on multi-dimensional analyses of globalisation by constructing frameworks and concepts. This is useful, but does not provide a solid scientific footing with which to evaluate the over-arching phenomenon of globalisation. On the other hand, the 'quantitative' side of research, with its focus on data, statistics and indices, runs the risk of oversimplification. As we have argued, to confront new questions on the essential nature of globalisation requires an interdisciplinary approach … (alternatively) a possible solution to these issues is to assess globalisation by thematic order. (Dreher et al., 2010, p. 181–182)

Consequently, studies on the influence of globalisation across many fields, including economics, yield results that are often perceived to be problematic, speculative, contested, and controversial (Piper, Abdi, Puplampu, & Sefa Dei, 2007). However, while the findings are probably not conclusive and authoritative, they are regarded as generally persuasive in providing some qualified insight into some specific aspect of globalisation. This study proceeds with such challenges and pitfalls in mind. The guiding principle in this work is that of dealing with science education as a globalised phenomenon such that the focus is on the variables, themes, ideas, and practices that show the diffusion of and interconnectedness of global consciousness and consensus in science education (cf. Kluver & Fu, 2004) while also focusing on the extensity, intensity, velocity, or impact of the variables over defined geographical boundaries (Dreher et al., 2010). The over-arching criteria are that such attributes should be in concert with the 'common good in today's knowledge-based, creative, interdependent world' (Fullan & Langworthy, 2014, p. 2).



## Findings and Discussion of Emergent Cross-Border Themes and Trends in Science Education in Literature

The write-up of this discussion section eschews a positivist tradition of separating research findings from their discussion and analysis. This said, throughout the paper the findings of the study are interspersed with the discussion. The findings and discussions revolve around the following broad areas emerging from data analysis: English language as a language of instruction in science education in Anglophone Sub-Saharan Africa; Aid Agencies as drivers of globalisation of science education in Anglophone Sub-Saharan Africa; and the role internationalisation plays in the globalisation of science education in Sub-Saharan Africa. The foregoing are the over-arching concerns and themes that are useful in this paper in two ways: firstly, they help organise and add coherence to the data; and secondly, they provide a platform for discussing the findings within the wider literature (Miles & Huberman, 1994).

### *English Language in Science Education in Sub-Saharan Africa*

English language, alongside other native languages, is the language for conducting official (government) business in various ways, including being a medium of

instruction in science classrooms in nearly all Anglophone states in Sub-Saharan Africa. Studies on the influence of English language on the teaching of science in Anglophone nation-states world-wide are readily available (e.g. Jenkins & Whitfield, 1974; Lewis, 1972; Prophet, 1990; Wellington et al., 1996), but nearly all treat the subject (i.e. English as a medium of communication in science classes) as a curriculum and pedagogy issue. The general approach in studies focuses on the linguistic and conceptual problems that the use of the English Language poses in science teaching (Lewis, 1972), particularly as an impediment to learning: the English language is taught separately in schools, with aims that are unrelated to science and often with little professional acknowledgement of the special conceptual tasks facing the learner in science classes (Barnes, 1969). However, the strategies for dealing with the problem have been rather varied, ranging from calls for adoption of the native language in teaching science (despite the fact that native languages in Sub-Saharan Africa are not standardised and institutionalised for teaching science) to some educators advocating the *status quo* in which English is the sole medium of teaching science. Those seeking a compromise between the two extremes have suggested 'code switching' (Rollnick & Rutherford, 1996) in science classrooms for the sake of motivating the learners and improving their cognitive development (Ncedo, Peires, & Morar, 2002).

However, though nearly all arguments concentrate on the conceptual and linguistic challenges in teaching science in a foreign language are valid, they do not acknowledge that they (i.e. challenges) need to be reconciled with the currency of both scientific knowledge and English language as media of globalisation. The literature also shows the co-existence of two diametrically opposed schools of thought on the subject. These are explained briefly here to bring some perspective to the presentation. One school of thought argues for a delicate balancing act, in which proper recognition is given to English language in globalisation, but not at the expense of local languages. For instance, according to Crystal (2003), English is now arguably 'so widely established that it can no longer be thought of as "owned" by any single nation' (p. 26); its dominance is consistent with the view that 'any language at the centre of such an explosion of international activity (*such as the industrial revolution*) would suddenly have found itself with a global status' (Crystal, 2003, p. 8). However, in an attempt to reconcile the globalisation mandate with other realities on the ground, Crystal (2003) suggests that 'languages of identity need to be maintained. Access to the emerging global language—widely perceived as language of opportunity and empowerment —needs to be guaranteed' (p. 28).

In articulating the second school of thought, Zughoul (2003) argues that some confusion needs to be cleared up first, regarding seeing English as a 'language of globalisation' or a 'medium of globalisation'. Zughoul (2003) notes incisively that:

> the spread of English as the language of globalisation, it is contended, cannot be fully understood without the realization of the hegemonic and imperialistic nature of English. It is also shown that English is unilateral in vision and it forms a real threat to other languages and cultures (p. 106) … English does not only serve as a medium of globalisation, it also serves as a tool that facilitates and finally brings about more facets of globalisation … the functionalism of English and its relationship to occupational,

> economic and social mobility, as well as the privileges that users of the language can get in terms of prosperity, are further contributing to its spread as a language of globalisation. (p. 121)

However, the paucity of literature or research in this area in Sub-Saharan Africa makes it difficult to understand the bigger picture that emerges continuously with every curricular reform in which English language is an integral part of the change. Since the medium rather than the message is important, English language as a medium of globalisation may be analogous to, for instance, the internet, which has become more than just a medium for connectivity, networking, and participating in the global village—it has become fundamental in engendering a sense of belonging to the global village. This analogy is significant as it encourages a re-conceptualisation of the use of English in science education. According to Law (2004), English now is a generic and transnational skill, while Zughoul (2003) aptly regards it as a working language and the international currency of science and technology. Undoubtedly, it appears the teaching of science in this language becomes an empowerment issue in terms of preparing individuals for participating in the ever-competitive contemporary market-driven environments.

In terms of research, it means rethinking perspectives of the cultural paradigm to realign them with the thinking that English in a global context might be a necessary evil. Thus, globalisation comes across as a viable alternative framework for redirecting or re-thinking arguments on English language in science education as a medium of instruction, to arguments on English language as a commodity to give one access to internationally competitive environments, where returns could be good in comparison to nationalist intonations heralding patriotism and nation-state building. The use of English language in science education in Sub-Saharan Africa clearly requires some management of the emergent tension between its cultural imperialist tendencies and it being more than a generic transnational skill, but a medium of globalisation. By extension, the new meaning of science education that emerges needs exploring and articulating for the world, and indeed for Sub-Saharan Africa.

## The Role of Aid Agencies in Science Education in Sub-Saharan Africa

The role and general influence of supranational aid agencies such as the United Nations through UNESCO/UNICEF/UNDP, World Bank, and the International Institute for Educational Planning in education are widely covered in the literature. The influence is noticeable in several critical areas in science education, namely policy development, curriculum reform (inclusive of pedagogy, content, examinations, and assessment), human resource development (through specific strategies and models of teacher training and development), and teaching resources (textbooks, laboratory equipment, laboratories). See, for instance, Altinyelken (2010), Bregman and Bryner (2003), Guthrie (1990), Kellaghan and Greaney (2001), Lewin (2000), Tabulawa (2003), and Verger, Edwards, and Altinyelken (2014) for a broad discussion of the involvement and influence of aid agencies in education.

Aid Agencies have for a long time acted in nearly all developing countries across the world as sales and marketing agents in science education. They are also essentially what Kluver and Fu (2004) refer to as 'cultural proxies—the conduits by which ideas, beliefs and values are transmitted' (p. 1) in global contexts. Science education itself is also entangled in 'the regimes of control and contours of biocapitalism' (Bazzul, 2013, p. 975) and the aid is effected with relative ease since 'modern states do not rely on force, but on forms of knowledge which regulate populations by describing, defining, and delivering the forms of normality and educability' (Olssen, 2004a, p. 67) as 'ways new forms of control and power are legitimated by complex discourses which take a claim to rationality and which are embedded in diverse institutional sites' (Olssen, 2004a, p. 58).

Generally, aid agencies in the 1960s until the late 1980s structured their reform packages in education as a response to the overwhelming economic and human challenges confronting developing countries. The aid agencies often perceived their multifaceted involvement in such schemes as a moral and ethical imperative. One such reform was the rapid spread by UNICEF in developing countries across the globe in the 1970s of modified versions of the Scottish Integrated Science Scheme (Chisman & Wilson, 1989) which was launched in Scotland in 1969. Many versions of the Integrated Science curriculum are still in use in many developing countries to this day. This is because integrated science has a relatively long history of institutionalisation in many countries, and it offers some perceived convenience and relevance in terms of cost of implementation (teachers, equipment, books); flexibility of content to suite target pupils of ages up to early adolescence; and adaptability to ever-changing socio-economic imperatives.

In contrast to earlier intervention strategies, aid agencies have currently redefined their agenda and operational frameworks in the context of globalisation in which education—policies, principles, practices, and priorities—is portrayed as a commodity with some indispensable virtues for the twenty-first century society, driven by and living in knowledge-based economies, including in Africa (see Caffentzis, 2008). In this context, according to Moutsios (2009), the enhanced role of the World Bank/IMF (International Monetary Fund), World Trade Organisation and OECD in education policy intensified and expanded dramatically from the 1990s onwards in ways that not only expressed the process of globalisation but also defined it. The extent of the influence wielded by IMF in education arises in part from the fact that of the 192 states recognised by the United Nations, 185 are members of the IMF and the World Bank (Moutsios, 2009). For instance, the impact of IMF in shaping education reforms through SAPs in many countries is widely documented in literature (see, for instance, Graham-Brown, 1991). UNESCO and Commonwealth Fund for Technical Cooperation have also been involved over a long time in curricular reforms, teacher development, and publication of 'source books' for science educators in Anglophone Sub-Saharan Africa (Chisman, 1985; UNESCO, 1970).

The agenda of what is considered valuable by aid agencies is driven by concerns with commodification of knowledge characterised by certain practices, values, and skills in education. In the broader sense, 'commodification' is the process by which 'social

domains and institutions, whose concern is not producing commodities in the narrower economic sense of goods for sale, come nevertheless to be organised and conceptualised in terms of commodity production, distribution and consumption' (Fairclough, 1992, p. 207). In the epoch of commodification of education, the emergent trends point to some proposed policies that 'purport to serve the principles of relentless economic competition which is now globalised and knowledge-based … Knowledge is placed at the heart of global economic competition and by extension knowledge transmission, acquisition and certification, namely education' (Moutsios, 2009, p. 476). This happens within a broader framework of neo-liberalism promoting open boards, floating exchange of ideas within a transnational system of alliances (Olssen, 2004b). The World Bank, which currently overshadows other international aid agencies in terms of funding, technical and knowledge-production capacity in science education (Verger et al., 2014), was initially reluctant to involve itself in education, but became a major player largely because of its 'conception of education and development as human capital for economic growth and its "one-size-fits-all" approach' (Robertson et al., 2007, p. xii). Consequently, commodification of education reshapes the meaning of professional knowledge and expertise—the

> practice itself (that) is commodified. Value replaces values. Moral reflection is unnecessary. What is needed is flexibility, in terms of both skills, interest, application and morality. The new knowledge worker should not be encumbered by scruples. Here cold calculation and extreme values predominate. (Ball, 2004, p. 16)

So far, the universal or transnational reforms prompted by the commodification of science education in Sub-Saharan Africa have triggered a series of conferences and in-service workshops that are now a convenient platform for the transmission and cascading of new ideas, practices, ideology, and pedagogy across all levels of bureaucratic structures in some countries such as, Namibia, Botswana, and other states in Southern Africa. For instance, the promotion of constructivism in Sub-Saharan Africa—alongside mixed ability teaching (Koosimile, 2002), practical work in science (McDevitt, 1998), criterion-referenced assessment, learner-centred pedagogy, and course work assessment—are mainly restricted to periodic workshops for teachers (see O'Sullivan, 2002, 2004) as they are treated as issues for continuous professional development. At the heart of transnational policies in science education in Sub-Saharan Africa are borrowing and replication of best practices that are required to achieve certain aims and success in transnational policy contexts (Moutsios, 2009). In this way, some benefits of globalising education are fast being entrenched across Sub-Saharan in Africa such as increasing attention to teaching quality, availability of more resources for teaching and support facilities (cf. Ozerdem, 2007), and presenting a united front rather than a fragmented approach to issues in education of regional and international importance. The underlying message that is communicated through the workshops and curricular reforms, as Ball (2004) observes, is that

> a new kind of teacher and new kinds of knowledge are 'called up' by educational reform—a teacher who can maximise performance, who can set aside irrelevant principles, or outmoded social commitments, for whom excellence and improvement (in whatever forms

> required) are the driving force of their practice. The notion of 'doing a good job' in these terms is reduced to a 'thin' version of professionality in terms of accounting for measurable outcomes. (p. 16)

The 'thin' version of professionality is already manifesting itself in Sub-Saharan Africa. For instance, the professional autonomy of teachers, who are often regarded as resources for education (c.f. Davies, 1988), is frustrated because teachers are trained literally on the official curriculum as a subtle way of indoctrinating them to be more attuned to, and responsive to, the dictates of the government-driven reforms which are, supposedly, in their own right, a massive socio-political-and-economic investment in education. Also, surprisingly, despite the massive commitment to reforms of most governments, some of them would promote practices or activities that pay lip service to the prevalent global reform agenda. A case in point is the launching of in-service workshops on constructivism for teachers in Botswana, run by the Free University of Amsterdam. While the workshops coincided with the global resurgence of constructivism in science education in the late 1980s and the early 1990s, they failed to embed the constructivist ideology in the public school system because the government had little faith in its currency to enhance the quality of teaching and education. As a result, some new sets of science textbooks framed within the constructivist framework, such as that by Motsumi, Motswiri, Mpugwa and Prophet (1999), did not elicit any interest from the government—the sole client for such a book. The book was declined for use in science classrooms because it was found to be focused more on conceptually engaging learners in learning science than on rapid dissemination of science content, which underlies some entrenched practices in schools. The book finally made it into schools after substantial revision of its original focus (i.e. a constructivist ideological stance) as publishers were under pressure to make it a commercially viable project through aligning its contents with the dictates of clients (i.e. government).

Another area highlighting some influence of globalisation in science education in Anglophone Africa is in the assessment of learning and its implications to knowledge-based societies. It suffices here to state that the role aid agencies and other institutions play in diverse assessment packages in Sub-Saharan Africa is also well documented in the literature. See, for instance, Bregman and Bryner (2003), Broadfoot and Black (2004), Carter (2005), DeBoer (2011), Kellaghan (2001), and Lewin and Dunne (2000). For instance, the Third International Mathematics and Science Study (carried out since 1995 by the International Association for the Evaluation of Educational Achievement—an international organisation of national research institutions and governmental research agencies. See https://nces.ed.gov/TIMSS/results11.asp) with 57 and 56 countries participating at Grades 4 and 8, respectively in 2011, develops international league tables based on the performance of pupils in international mathematics and science examinations. The examinations 'define(s) education primarily in terms of its economic value, and learners as human resources, required by the global production system' (Moutsios, 2009, p. 476). The relationship of the assessments to the globalisation of science education in Sub-Saharan Africa is also readily summed up thus:

> … they seem to echo a view of education as utilitarian, perceive the need to develop human capital and show concern for performance/results and efficiency … questions remain about the extent to which they might contribute to many of the factors associated with globalisation. (Kellaghan & Greaney, 2001, pp.97–98)

The motive behind international assessment is widely about accountability and returns on investment, both often expressed in terms of the importance of knowing 'the extent to which students actually learned as a result of educational opportunities provided' (Kellaghan, 2001, p. 88), and the 'relative national success in a world of increasingly global competition has served significantly to reinforce the prevailing domination of established forms of educational assessment' (Broadfoot & Black, 2004, p. 14). However, 'information about such assessments does not always reach the literature available to an international audience; often an assessment results only in a national report, which may or may not be published' (Kellaghan, 2001, p. 88).

Overall, while some positive influence of globalisation is noted in various spheres of education in Sub-Saharan Africa, there are also reports in the literature of widespread failure and inconclusive results on the influence and cost-effectiveness of intervention as in reforms in education by supranational aid agencies (Dembélé & Miaro-II, 2003). The concerns resulted in, among other things, the hosting of the Paris Declaration on Aid Effectiveness in 2005, and the Accra Agenda for Action in 2008 (see www.ausaid.gov.au). The agenda focused on improving the quality of the delivery, the management of aid through good practices, changing paradigms in aid management and influence evaluation (see White, 2009). Some concerns exist that some of the programmes in education are over-ambitious (Chapman & Quijada, 2008), while others are imposed on aid recipients (Mcgrath, 2002). Moreover, it is claimed that as aid agencies aim for replicability of programmes, the aid packages end up with similar logic, priorities, and expectations across diverse socio-economic contexts (Welmond, 2002). Hence, there are suggestions that aid packages lack an explicit development theory on globalisation, for instance, to guide implementation (Danielson & Wohlgemuth, 2002), so that they fail on key system issues relating to capacity, policy, and efficiency and management in education and teacher development (Gillies, 2010). It is, nonetheless, intriguing to learn from the literature of the reluctance of some researchers to report on the influence and cost effectiveness of aid (Doucouliagos & Paldam, 2009). Sometimes it appears, according to Schulpen (2007), that the question of effectiveness of aid is perhaps irrelevant, because the aim of aid 'in development is to lighten the lives of some people in developing countries now by providing those things that they lack' (p. v). However, an examination of the influence of globalisation on science education in Sub-Saharan Africa has to contend with such constraints.

## Internationalisation and Science Education in Sub-Saharan Africa

Internationalisation is widely described in the literature as one of the major processes of globalisation. See, for instance, Kress (1996) and Stromquist (2007). However, the functional definition adopted in this paper is that supplied by the vice-chancellor of the University of Bristol in UK. He notes that internationalisation embodies, among other

things, 'a vision that promotes and encompasses the international … numerous collaborative international linkages, whether for research or for student and staff exchange' (http:www.bris.ac.uk/university/vc/education-intl.html). Furthermore, according to Altbach (2004) 'internationalisation includes specific policies and programmes undertaken by governments, academic systems and institutions, and even individual departments or institutions, to cope with or exploit globalisation' (p. 6). Internationalisation, thus, is the medium through which globalisation takes effect, including in science education in Sub-Saharan Africa.

The central thesis in developing this section is that Universities and Teacher Colleges in Sub-Saharan Africa exist mainly to drive the modernisation of their respective countries by producing the much needed human resource or human capital for the various sectors of both the local and international economy. The said institutions have the largest concentration of academics who, in most cases, are key agents for embedding various aspects of internationalisation into science education in Sub-Saharan Africa. Thus, an arguably more nuanced account of globalisation emerges through recognition of diverse groups with vested interest in science education:

> The effect of these groups and organisations' involvement is to make clear that the move towards greater market forces in education politics and policy has not been complete—although it has coincided with deepened understanding and complexity regarding the identity of such groups and the scope and capacity of effective policy making. (Burton, 2014, p. 326)

They participate in the development of science education by virtue of their profession and their capability to act in an advisory capacity and/or as consultants to their governments and aid agencies. Apart from being consultants, academics (and any other persons acting in a similar or equivalent capacity) drive the internationalisation of science education through many other activities including, but not restricted to, research and diffusion of new ideas through publications and conferences; serving on editorial boards; participating in curriculum development and professional support of teachers; and being resource persons or experts in seminars and workshops in science education. Thus, understanding the *modus operandi* of academics in their strategic areas of engagement (i.e. teaching, research, outreach, professional service) invariably offers insights into some of the many pathways through which internationalisation drives science education in Sub-Saharan Africa. Consequently, this section explores three areas which hold the promise of unearthing evidence of internationalisation in science education in Sub-Saharan Africa. They are: mobility of students in countries in Sub-Saharan Africa; international networks in science education within Sub-Saharan Africa; and the collaboration amongst some key stakeholders in science education across Sub-Saharan Africa.

### *Mobility of Students Among Countries in Sub-Saharan Africa*

The mobility of students between and among countries in Sub-Saharan Africa for purposes of accessing quality education that is either not available in their home countries

or is exclusive is widely accepted as a hallmark of the influence of internationalisation in education (cf. Altbach, 2004; Sehoole, 2006). As Smith, Reid, and Petocz (2009) (see also Pauw & Malete, 2011; Sehoole, 2006) suggest, internationalisation in the context of teaching is manifest in curriculum

> via content (examples, issues, subject matter), methods (pedagogy, epistemology) and the characteristics of the student body (experience, mobility, heterogeneity). . . . (*while*) teaching in the context of internationalisation . . . is seen as encouraging students to make a personal commitment to the area represented by course content, including internationalisation as part of that. (p. 5)

Thus, education that is highly sought after by foreign students in another country in Sub-Saharan Africa ideally allows them the advantage of gaining some international experience in science education, while they simultaneously gain a head-start in both education in general and in securing some prospects for socio-economic advancement in life ahead of other students, particularly those within the public school system. Thus, as Patrick (2013) suggests, within the idea of the knowledge economy in education rests a concept of each individual as being economically responsible, economically self-interested, self-regulating, and market-knowledgeable.

The earliest trends of mobility of students in Sub-Saharan Africa probably intensified during the mid-1970s because of the increasing population in Africa which was accompanied by the rising demand for access to high-quality education in many newly independent states. Students from middle class families in Southern Africa, for instance, criss-crossed the region in search of reputable international curricula and learning experience in Zimbabwe (then a British Colony), Swaziland, Botswana, and even in the then apartheid South Africa. Students enrolling into high schools in any of these states searched particularly for those schools with a reputation for excellence in delivering the University of Cambridge A- & O-level curriculum from the UK. Similarly, elsewhere in East Africa (Uganda, Kenya, Tanzania), the Nuffield Science and the East African Secondary School Science Programme (see, Lewin, 1990; Lillis & Lowe, 1982) fostered a regional collaborative framework for the spreading of ideas, trends, and themes, giving character to science education while simultaneously influencing the movements and enrolment patterns of students in schools in the region. However such trends, signalling some convergence in quality and value of education, are now being actively and overtly pursued and exploited for their potential in terms of stimulating economic growth and income generation, by way of offering quality education that targets international students. For instance, Botswana has of late established the Botswana Education Hub (see www.behbw.com) with two key aims: to promote economic diversification and sustainable economic growth in Botswana through education; and to package and market education to attract international students to do their secondary and tertiary education in Botswana. The initiative is also driven by the thinking that education is a commodity that can be marketed worldwide for economic gains—a direct consequence of globalisation and internationalisation of education.

Some similar initiatives prevail in the prestigious schools and tertiary institutions, formerly reserved for whites, in the formerly racially segregated South Africa; the

institutions have since 1994 revised their admission policies and school ethos to become multiracial for purposes of enrolling students across the racial divide within South Africa (Sehoole, 2006) and from across states in Sub-Saharan Africa. Intriguingly, the science curriculum in general within the sub-region in Southern Africa shows a rather strong character of convergence in terms of origins, purpose, scope, quality, and thrust as they (i.e. various curricula) predominantly aim at preparing youth for pursuing tertiary education in local and international universities. However, disparities prevail in general between the curriculum taught in public and private schools—the latter are market-driven and often relatively well endowed with resources to deliver education of high quality. Overall, the over-arching consideration in this section is that the mobility of students in Sub-Saharan Africa is arguably an indication of the manifestation of the influence of internationalisation (and indirectly globalisation) through the 'convergence of what is valued, what is assessed, and what is thought relevant to future employment' (Lewin & Dunne, 2000, p. 380). What seems clear, though, is that access to quality education is important, particularly in the areas of science and technology, and that globalisation—the idea of global competitiveness of individuals—has encouraged parents, governments, and aid agencies to value science and technology-related courses at all levels of education.



### *International Networks in Education within Sub-Saharan Africa*

The mainstream literature on the influence on globalisation of education in Sub-Saharan Africa tends to be skewed heavily towards South Africa, as the country has possibly the highest number of academics with a prolific research and publications profile. Consequently, this impacts somewhat on accounting for networks and activities that showcase the manifestation of internationalisation in science education in Sub-Saharan Africa. However, the networking of professionals in areas of research, teaching, and professional service in Sub-Saharan Africa, taken to be indicative of the internationalisation of science education, is explored here in the context of two organisations with strong regional and international presence in Anglophone Sub-Saharan Africa. Those organisations are the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE), and the Strengthening of Mathematics and Science in Secondary Education (SMASSE) project. However, the intention of dealing with the two is not to overshadow or marginalise the significant role that other organisations such as, for instance, the Association for Development of Education in Africa; New Partnerships for Africa's Development; and, the African Union have had in science education in Sub-Saharan Africa (see Michael & Orado, 2009).

The SAARMSTE (see www.saarmste.org), with its headquarters located in South Africa, has since the early 1990s been funded by the Department for International Development (British Government). SAARMSTE, which is effectively a platform and forum for networking of mathematics, science, and technology educators, has a diverse membership from Africa and beyond. The organisation, among other professional activities, engages in professional development (i.e. capacity building) in

member states through promoting research and publications in science, mathematics, and technology education; and in popularising science education and its agenda through conferences, seminars, and workshops. SAARMSTE now has 13 chapters in 8 countries, and a peer-reviewed journal (the African Journal of Research in Mathematics, Science & Technology Education) with international contributors and readership. The journal was established in 1997, and is now published by the Taylor and Francis group. The annual SAARMSTE conferences attract teachers, graduate students, academics, international scholars, researchers, and policy developers, mainly from Africa and Europe. The wide range of topics presented at conferences and in journal articles comprise mainly contemporary themes which are informed by perspectives drawn from the international peer-reviewed literature in science education. It is also through the presentations at the conferences that universities, through their academic staff being actively involved in research and in innovation in curriculum and pedagogy, reveal some significant convergence in terms of thought and action in relation to matters in science, mathematics, and technology education in Sub-Saharan Africa. Hence, one can safely posit here that the developments around SAARMSTE are critical in the internationalisation of science education, as they embed some practices in teaching contexts while also propagating to the world those perspectives, ideologies, and practices considered important in contemporary Sub-Saharan Africa.

Another initiative, this time with a phenomenal geographic spread or footprint in Sub-Saharan Africa, is the SMASSE project. This is a Technical Cooperation initiative funded by the Government of Japan. Kenya has since 1998 served as headquarters for SMASSE; Kenya also provides professional and technical expertise in all aspects of project management to member countries. SMASSE so far has around 32 chapters in Africa, in countries such as Egypt, Ethiopia, Kenya, Uganda, Nigeria, Niger, Malawi, Botswana, Rwanda, Burkina Faso, Senegal, Lesotho, Swaziland, South Africa, and Mozambique (Michael & Orado, 2009). Unlike SAARMSTE, SMASSE has a narrower focus in science education, as the organisation aims to provide opportunities for replicating and sharing of good practice, promising approaches and strategies to mitigate emerging challenges in teacher development through in-service training workshops. SMASSE hosted eight major international conferences between 2001 and 2009 in countries such as Ghana, South Africa, Rwanda, Senegal, Zambia, and Kenya (Michael & Orado, 2009). The conferences and workshops held by SMASSE are instrumental in spreading ideas, trends, perspectives, and themes in science education among member states in Sub-Saharan Africa. However, the extent of influence of SMASSE in science education in Sub-Saharan Africa is generally unreported in the mainstream peer-reviewed international journals. This is possibly because the majority of participants in the initiative are senior government officials or technocrats who, despite their direct involvement, influence, and control of science education in their respective countries, have relatively little or no inclination to publish research or academic papers in line with their activities in SMASSE.

Generally, while internationalisation is hard to measure with respect to initiatives reported in this section, it is clear that Sub-Saharan Africa too is attempting to be proactive in dealing with some issues in science education within a collaborative

framework. Clearly, the gestation periods of these initiatives could be long, particularly given that a good number of countries that are involved in both the SAARMSTE and SMASSE initiatives have a history of weak economies and an average-to-low project implementation capacity in science education.

*Collaboration Amongst Some Key Stakeholders in Science Education*

The internationalisation of science education in Sub-Saharan Africa is also noticeable in the exchange of information and collaborative engagements amongst academics and universities. Generally, universities in Sub-Saharan Africa provide sites for academics to exercise their professional autonomy while moulding teachers into 'change agents' (cf. Lane, Lacefield-Parachini, & Isken, 2003) in science education. A notable change in dealing with teachers in Sub-Saharan Africa puts emphasis on shifting the predominant teacher-training paradigm from the somewhat entrenched traditional behaviourist focus to a more reflective practice (cf. Koosimile & Suping, 2011; O'Sullivan, 2002; Tafa, 2001; Zeichner & Ndimande, 2008). A distinct research and innovation agenda in indigenous knowledge systems and argumentation in science education in South Africa (see, Ogunniyi, 2007; Ramorogo & Ogunniyi, 2010; Scholtz, Braund, Hodges, Koopman, & Lubben, 2008) is also indicative of active attempts by academics in Sub-Saharan Africa to develop a locally relevant curriculum and practices. The initiatives are also a convenient way of driving globalisation through circumventing bureaucratic hurdles associated with courting governments to introduce some progressive reforms in science education at the national level. The major underlying theme of these changes in Sub-Saharan Africa context is that:

> Increasingly Africa's image is defined from within, rather than from abroad … there is a new eagerness among students and academics to engage with their counterparts elsewhere in the continent. Where collaboration has served mainly as a feeder of aid money into the continent from international partners and their donors, African academics are increasingly realizing the value of intra-African collaboration and mobility for the sake of addressing Africa's development challenges and harnessing its opportunities. (Pauw & Malete, 2011, p. 1)

A case in point for highlighting the emerging 'intra-Africa internationalisation' (Jowi, 2011) of collaborative engagements and interaction by academics and universities in Southern Africa relates to some recent activities at the Department of Maths and Science Education (DMSE) at the University of Botswana. Professor Meshack Ogunniyi, the current UNESCO Chair of Science Education at the University of Western Cape in South Africa, was in September 2010 hosted by DMSE on a week-long trip to deliver seminars and undertake programme reviews as a visiting scholar. Soon after, one senior lecturer in science education from the University of Botswana went on a year-long sabbatical to work with Professor Ogunniyi on indigenous knowledge systems and argumentation at the University of Western Cape. At roughly the same time, Botswana hosted three visiting scholars from universities and research centres in South Africa and Zimbabwe, and hosted yet another from Namibia in early 2012. The major highlight of the initiative was a visit to DMSE by a team of mathematics

and science educators from a university in Mozambique; the team was on a benchmarking and cultural exchange mission in Botswana. Clearly, as Pauw and Malete (2011) suggest,

> the goal of international academic networking is to support and participate in sustainable academic networks that will contribute relevant knowledge for Africa's immense developmental potential in the decades to come. To benefit from these current and future opportunities, African universities need to solidify their positions as African knowledge institutions of choice. (p. 2)

Ironically, however, few universities in Sub-Saharan Africa report widely on such collaborative efforts; in contrast, universities in America or Great Britain rarely miss an opportunity to make known where they stand on globalisation, internationalisation, and global competitiveness.

On the other hand, there is evidence that universities in America and the UK have contributed immensely to the internationalisation of science education in Sub-Saharan Africa (cf. Jowi, 2011). In the 1990s, the Universities of Leeds, Bristol, and York in UK established, respectively, links with the University of Botswana, a Teacher Training College in Gambia, and the University of Swaziland. Professor Zeichner, currently with the University of Washington in Seattle, has been involved in teacher education in Namibia (from 1994 to 2004), and he contemplates some involvement in professional teacher development in Ethiopia (http://education.washington.edu/areas/tep/profiles/zeichner.html). Yet another significant development showing a marked internationalisation drive in the 1990s in science education was in the area of teacher development in mathematics, science, and design and technology disciplines. At the time, many teachers from Africa were sponsored under the British Overseas Technical Cooperation programme to enhance their academic qualifications in different universities across Britain. During the period, the University of Bristol in England, among others, also offered a graduate programme for science and mathematics teachers and government officials mainly from Botswana, Gambia, Lesotho, Namibia, Swaziland, South Africa, and Zambia. As yet (as in case of other aid packages—see Doucouliagos & Paldam, 2009), the influence that the arrangements have had on the internationalisation of science education in the affected countries in Sub-Saharan Africa has seemingly not been reported in the literature.

Overall, all the movements or patterns in the internationalisation process cited in this section are possibly suggestive of the dialectical nature of globalisation (cf. Giddens, 1990) and its influence on science education in Sub-Saharan Africa. The patterns help anchor some practices in teaching, research, and curriculum development within science education in Sub-Saharan Africa, and possibly beyond. Admittedly, the pattern of alliances and interaction across the Anglophone Sub-Saharan Africa is somewhat intense, complex, and involved, and can possibly be unravelled through suitable case studies. Clearly, there is evidence so far that some academic institutions collaborate in areas of staff development and knowledge exchange, and in benchmarking in areas of teaching, research, and publications in ways that might have a significant bearing on science education.

## Reflective Conclusion

In examining the influence of globalisation on science education in Sub-Saharan Africa, this paper generally portrays globalisation as an opportunity for the development of science education in Sub-Saharan Africa. However, the paper has deliberately eschewed taking a stance on whether globalisation is a good or bad concept or phenomenon. This is partly because countries in Sub-Saharan Africa have so far failed in defining or redefining globalisation to guide research on how it manifests itself in individual states, or across the region. This may mean that developing countries in general are losing out in many ways on opportunities for exploring and exploiting globalisation for their own benefit and enhanced outcomes. Consequently, developed countries at the forefront of popularising and actualising globalisation seem to derive more socio-economic benefit from globalisation than the entire Sub-Saharan Africa region. This is more like the metaphorical case in which the rich always get richer while the poor get poorer by the day, because of their perennial failure to see the bigger picture on how to survive with globalisation as a concept, practice, and praxis. Subsequently, the examination of the influence of globalisation on science education in Sub-Saharan Africa in this work has been a challenge, due to a lack of a consolidated and extensive corpus of evidence on the effects of globalisation in the literature. That situation forced this work to be guided by the maxim, typical of qualitative research, that:

> a numerical count of incidents (*that showcase globalisation in Sub-Saharan Africa)* may not give a true sense of their relative importance, and that a single event may be more significant than a large number of other occurrences, or, and this may be a more important point, may provide a key insight into the processes being described. (Croll, 1986, p. 165)

Furfey (1965) elaborates the point thus:

> A few cases, no matter how collected, or even a single indubitable case, will be sufficient to prove at least that a certain phenomenon is possible. Here the logical axiom applies, *Ab esse ad posse valet illatio* ('Inference from existence to possibility is valid inference'). … In the meantime, however, the mere knowledge of what can happen, knowledge of the range covered by exceptional behaviour, is itself valuable to science, and the study of even haphazard cases can be useful in this way. (p. 341–344)

Operating within such a perspective allowed this work to supply a few illustrative examples that provide a bird's eye view of possibilities of where to look for influence broadly in the macro-, meso- and micro-contexts of reality in the globalisation of science education in Sub-Saharan Africa. According to Turner (2005), the macro-level reality consists of a larger number of individuals organised in space in response to a force such as globalisation. At the meso-level of reality, segmentation, differentiation, and integration of operations are the key forces that operate within corporate units (e.g. aid agencies, SAARMSTE, SMASSE), in for instance driving activities around globalisation in science education. The micro-level of reality, according to Turner (2005), consists of episodes of face-to-face interaction, as in 'focused encounters', where individuals have a common focus of attention. Examples in this work are

drawn across the three contexts, even though the framework was not used as a basis for organising the presentation.

The major apprehension remains whether or not such examples can project onto the bigger image of the realities of globalisation in Sub-Saharan Africa. However, there is no pretense that the examples supplied in this paper are typical or representative; they only highlight trends indicative of some influence of globalisation from within Sub-Saharan Africa. It is hopefully the desire of every researcher in this area to find more examples that can develop this study further, by way of enriching the findings and unearthing the complexities associated with globalisation in Sub-Saharan Africa. Furthermore,

> to improve research, we need a strong theoretical foundation where the logic and normative assumptions are clearly explicated and the concepts used are coherent and understandable in light of the theoretical approach taken. In addition, researchers and practitioners should strive to develop some degree of common language and common concepts that can serve to develop more opportunities for finding relationships and links between the broad range of disciplines, theories and methods that are present in the field. (Edelstein, 2014, p. 1)

Finally, it is envisaged that the most notable contribution of this paper will be in encouraging case studies on globalisation and its manifestations on science education in Sub-Saharan Africa. Clearly, while the issue of the influence of globalisation proves to be complex and illusive across many areas in education, this paper has provided some examples hitherto missing in the literature on globalisation in the context of Sub-Saharan Africa.



## Disclosure statement

No potential conflict of interest was reported by the authors.

## References

Abdi, A. A. (2006). Culture of education, social development, and globalisation: Historical & current analyses of Africa. In A. A. Abdi, K. P. Puplampu & G. Dei (Eds.), *African education and globalization: Critical perspectives* (pp. 12–30). Lanham, MD: Lexington Books.

Al'Abri, K. (2011). The impact of globalisation on education policy of developing countries: Oman as an example. *Literacy Information and Computer Education Journal*, *2*(4), 491–502.

Altbach, P. G. (2004). Globalisation and the university: Myths and realities in an unequal world. *Tertiary Education and Management*, *10*, 3–25.

Altinyelken, H. K. (2010). Pedagogical renewal in sub-Saharan Africa: The case of Uganda. *Comparative Education*, *46*(2), 151–171.

Ball, S. (2004). Education for sale! The commodification of everything. Department of Education and Professional Studies Annual Lecture, Institute of Education, London (June 2004).

Ball, S. J. (2001). Global policies and vernacular politics in education. *Currículo sem Fronteiras*, *1*(2), xxvii–xliii.

Ball, S. J. (2012). *Global education Inc: New policy networks and the neo-liberal imaginary*. New York: Routledge.

Barnard, A., & Burgess, T. (1996). *Sociology explained*. Cambridge: Cambridge University Press.

Barnes, D. (1969). *Language, the learner and the school*. Harmondsworth: Penguin.
Bazzul, J. (2013). Education in the age of biocapitalism: Optimizing educational life for a flat world. *Science Education*, *97*(6), 975–978.
Bhandari, A. K., & Heshmati, A. (2005). *Measurement of globalization and its variations among countries, regions and over time.* Discussion paper No. 1578. Bonn, Germany.
Bregman, J., & Armstrong, A. (2004). First *regional conference on secondary education* in Africa (SEIA) held in Kampala, Uganda June 9–13, 2003. Washington, DC: World Bank.
Bregman, J., & Bryner, K. (2003). Quality of secondary education in Africa (SEIA). Association for the Development of Education in Africa (ADEA) Biennial Meeting 2003 held at Grand Baie, Mauritius on December 3–6, 2003.
Brennan, J., Enders, J., Valimaa, J., Musselin, C., & Teichler, U. (2008). *Higher education looking forward: An agenda for future research*. Retrieved from www.esf.org./fileadmin/Public … /HEIP … 01.pdf
Broadfoot, P., & Black, P. (2004). Redefining assessment? The first ten years of assessment in education. *Assessment in Education*, *11*(1), 7–26.
Burton, G. (2014). Theorising the state and globalisation in education politics and policy. *Práxis Educativa, Ponta Grossa*, *9*(2), 315–332.
Caffentzis, G. (2008). A critique of commodified education and knowledge from Africa to Maine. Russell Scholar Lecture, University of Southern Maine, Portland, ME, February, 12.
Carter, L. (2005). Globalisation and science education: Rethinking science education reforms. *Journal of Research in Science Teaching*, *42*(5), 561–580.
Çelik, V., & Gömleksiz, M. N. (2000). A critical examination of globalization and its effects on education. *Fırat Üniversitesi Sosyal Bilimler Dergisi*, *10*(2), 133–144.
Chandy, L. (n.d.). *Why is the number of poor people in Africa increasing when Africa's economies are growing? Brooking: Africa in focus*. Retrieved May 4, 2015, from http://www.brookings.edu/blogs/africa-in-focus/posts/2015/05/04/-africa-poverty-numbers-chandy?Cid=00900015020149101us0001-0504
Chapman, D. W., & Quijada, J. J. (2008). An analysis of USAID assistance to basic education in the developing world, 1990–2005. *International Journal of Educational Development*, *29*, 268–280.
Chisman, D. G. (Ed.). (1985). Proceedings of the Regional seminar on science and mathematics education in Botswana, Lesotho and Swaziland, held in May 1985, Maseru, Lesotho.
Chisman, D. G., & Wilson, B. J. (1989). *Partners in development. A review of science and mathematics education*. London: British Council.
Cobern, W. W., & Aikenhead, G. S. (1998). Cultural aspects of learning science. In B. J. Fraser and K. G. Tobin (Eds.), *International handbook of science education* (pp. 39–52). London: Kluwer Academic.
Coll, R. K., & Taylor, N. (2008). The influence of context of science curricula: Observations, conclusions and some recommendations for curriculum development and implementation. In R. K. Coll and N. Taylor (Eds.), *Science education in context* – An *international examination of the influence of context on science curricula development and implementation* (pp. 355–362). Rotterdam: Sense.
Croll, P. (1986). *Systematic classroom observation*. London: The Falmer Press.
Crystal, D. (2003). *English as a global language* (2nd ed.). Cambridge: Cambridge University Press.
Danielson, A., & Wohlgemuth, L. (2002). Swedish Development Co-operation in perspective. Retrieved from www.nek.lu.se/publications/workpap/Papers/WP03_8.pdf
Davies, L. (1988). Contradictions of control: Lessons from exploring teachers' work in Botswana. *International Journal of Educational Development*, *8*(4), 293–303.
DeBoer, G. E. (2011). The globalisation of science education. *Journal of Research in science Teaching*, *48*(6), 567–591.
Dembélé, M., & Miaro-II, B. (2003). Pedagogical *renewal and teacher development in sub-saharan* Africa: A *thematic synthesis, association* for the *development of education* in Africa, ADEA biennial

meeting 2003 (Grand Baie, Mauritius, December 3–6, 2003). Retrieved from www.adeanet.org/adeaPortal/adea/ … /4A_synthesemartial_e_final.pdf

Doucouliagos, H., & Paldam, M. (2009). The aid effectiveness literature: The sad results of 40 years of research. *Journal of Economic Survey*, *23*(3), 433–461.

Dreher, A., Gaston, N., Martens, P., & Van Boxem, L. (2010). Measuring globalisation-opening the black box: A critical analysis of globalisation indices. *Journal of Globalisation Studies*, *1*(1), 166–185.

Edelstein, R. (2014). Globalization and student learning: A literature review and call for greater conceptual rigor and cross-institutional studies. Centre for Studies in Higher Education, University of California. Retrieved from http://www.cshe.berkeley.edu/publications/globalization-and-student-learning-literature-review-and-call-greater-conceptual-rigor

Evans, J., Rich, E., Allwood, R., & Davies, B. (2008). Body pedagogies, P/policy, health and gender. *British Educational Research Journal*, *34*(3), 387–402.

Fairclough, N. (1992). *Discourse and social change*. Cambridge, UK: Billings & Sons.

Fensham, P. J. (2011). Globalisation of science education: Comment and a commentary. *Journal of Research in science Teaching*, *48*(6), 698–709.

Foucault, M. (1984). Right of death and power over life. In P. Rabinow (Ed.), *The Foucault reader* (pp. 258–272). New York, NY: Pantheon Books.

Fraser, B. J., & Tobin, K. G. (Eds.). (1998). *International handbook of science education*. London: Kluwer Academic.

Fullan, M., & Langworthy, M. (2014). *A rich seam: How new pedagogies find deep learning*. London: Pearson.

Furfey, P. H. (1965). *The scope and methodology of sociology: A meta-sociological treatise*. New York, NY: Cooper Square Publishers Incorporated.

Giddens, A. (1990). *The consequences of modernity*. Cambridge, UK: Polity Press.

Giddens, A. (2003). The globalizing of modernity. In D. Held & A. McGrew (Eds.), *The global transformation reader*: *An introduction to the globalisation debate* (pp. 60–66). Cambridge, MA: Polity Press.

Gillies, L. (2010). Aid effectiveness and education system reform: A systems approach EQUIP2 working paper, U.S. Agency for International Development. Retrieved from gec.aed.org/ … /EQUIP2/Aid%20Effectiveness%20and%20System%20Reform%20-%20WP.pdf

Graham-Brown, S. (1991). *Education in the developing world- conflict and crisis*. London: Longman.

Green, A., Little, A., Kamat, S., Oketch, M., & Vickers, E. (2007). *Education and development in a global era: Strategies for successful globalisation*. London: Department for International Development (DfID)(UK).

Guthrie, G. (1990). To the defence of traditional teaching in lesser-developed countries. In V. D. Rust & P. Dalin (Eds.), *Teachers and teaching in the developing world* (pp. 219–32). New York: Garland.

Hardman, F., Ackers, J., Abrishamian, N., & O'Sullivan, M. (2011). Developing a systemic approach to teacher education in Sub-Saharan Africa: Emerging lessons from Kenya, Tanzania and Uganda. *Compare*, *41*(5), 669–683.

Inda, J. X., & Rosaldo, R. (2008). Tracking global flows. In J. X. Inda & R. Rosaldo (Eds.), *The anthropology of globalisation: A reader* (2nd ed., pp. 3–46). Oxford: Blackwell.

Ingle, R. B., & Turner, A. D. (1981). Science curricula as a cultural misfit. *European Journal of Science Education*, *3*(4), 357–371.

Jegede, O. J. (1995). Collateral learning and the eco-cultural paradigm in science and mathematics education in Africa. *Studies in Science Education*, *25*, 97–137.

Jenkins, E., & Whitfield, R. (Eds.). (1974). *Readings in science education: A source book*. London: McGraw-Hill Book.

Jowi, J. O. (2011, November 20). *Universities rethink internationalisation*. University World News Africa Edition Issue 86. Retrieved from http://www.universityworldnews.com/article.php?story=20111120095222860

Kahn, M. (1989). Educational reform and the dependency paradigm: Some considerations from Botswana. *Compare*, *19*(2), 83–93.

Kamens, D. H., & McNeely, C. L. (2010). Globalisation and the growth of international educational testing and national assessment. *Comparative Education Review*, *54*(1), 5–25.

Kellaghan, K. (2001). The globalisation of assessment in the 20th Century. *Assessment in Education: Principles, Policy & Practice*, *8*(1), 87–102.

Kellaghan, T., & Greaney, V. (2001). *Using assessment to improve the quality of education*. Paris: (UNESCO) International Institute of Educational Planning.

Kluver, R., & Fu, W. (2004). The cultural globalisation index. Foreign Policy Online Web Exclusive. Retrieved from http://www.foreignpolicy.com/story/cmss.php?story_id+2494

Koosimile, A. T. (2002). Problems and challenges in promoting mixed ability teaching in Botswana. In C. Malcolm & C. Lubisi (Eds.), Proceedings of the 10th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education (pp. 182–188) held in January 2002 at University of Natal, South Africa.

Koosimile, A. T., & Suping, S. M. (2011). Pre-service teachers' attempts at debating contemporary issues in science education: A case study from Botswana. *International Journal of Educational Development*, *31*(5), 458–464.

Kress, G. (1996). Internationalisation and globalisation: Rethinking a curriculum of communication. *Comparative Education*, *32*(2), 185–196.

Lane, S., Lacefield-Parachini, N., & Isken, J. (2003). Developing novice teachers as change agents: Student teacher placements 'against the grain'. *Teacher Education Quarterly*, 55–68. Retrieved from: http://files.eric.ed.gov/fulltext/EJ852357.pdf

Law, W. (2004). Translating globalisation and democratization into local policy: Educational reform in Hong Kong and Taiwan. *International Review of Education*, *50*(5–6), 497–524.

Lazzarato, M. (2002). From biopower to biopolitics. *Pli: The Warwick Journal of Philosophy*, *13*(8), 1–6.

Lewis, J. L. (Ed.). (1972). *Teaching school physics: A Unesco source book*. Middlesex: Penguin Books.

Lewin, K. (1990). International perspectives on development of science education: Food for thought. *Studies in Science Education*, *18*, 1–23.

Lewin, K. M. (2000). *Mapping science education policy in developing countries. (World Bank, Human Development Network Secondary Education Series)*. Washington, DC: The World Bank.

Lewin, L., & Dunne, M. (2000). Policy and practice in assessment in Anglophone Africa: Does globalisation explain convergence? *Assessment in Education: Principles, Policy & Practice*, *7*(3), 379–399.

Lillis, K. M., & Lowe, J. (1982). The rise and fall of the school science project in East Africa. *Compare*, *17*(2), 167–179.

Liu, Y. (2012). Exploring the impacts of cultural globalization on cultural awareness/values and English writing in Chinese context. *Intercultural Communication Studies*, *XXI*(2), 94–110.

Maddock, M. N. (1981). Science education: An anthropological view point. *Studies in Science Education*, *8*, 1–26.

Malcom, C. (2002). HIV, globalisation and science curriculum in rural South Africa. In C. Malcolm & C. Lubisi (Eds.), Proceedings of the 10th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education, (pp. 228–233). held in January 2002 at University of Natal, South Africa.

Marshall, C., & Rossman, G. B. (1999). Designing qualitative research. Thousand Oaks, CA: Sage.

McDevitt, D. (1998). How effective is the cascade as a method for disseminating ideas? A case study in Botswana. *International Journal of Educational Development*, *18*(5), 425–428.

McGrath, S. (2002). The British department for international development and knowledge-based aid. *Compare*, *32*(3), 349–364.

McGrath, S., Akoojee, S., Gewer, A., Mabizela, M., Mbele, N., & Roberts, J. (2006). An examination of the vocational education and training reform debate in Southern Africa. Compare: *A Journal of Comparative and International Education*, *36*(1), 85–103.

Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. San Francisco, CA: Jossey-Bass.

Michael, W. M., & Orado, G. N. (2009). Managing *teachers and the instruction of mathematics and science*: Lessons from the SMASSE *experience in capacity development*. Paper presented at Secondary Education in Africa (SEIA) Follow-up Technical Workshop on Science and Mathematics, January 29–February 6, Tunis. Retrieved from info.worldbank.org/etools/library/latestversion_p.asp?objectID

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis – An expanded sourcebook* (2nd ed.). London: Sage.

Motsumi, O., Motswiri, M., Mpugwa, M., & Prophet, R. (1999). *Challenges in science: A junior secondary science course—Book 1/2/3*. Gaborone: Macmillan.

Moutsios, S. (2009). International organisations and transnational education policy. *Compare*, *39*(4), 469–481.

Ncedo, N., Peires, M., & Morar, T. (2002). Code switching revisited: The use of language in primary school science and mathematics classrooms. In C. Malcolm and C. Lubisi (Eds.), Proceedings of the 10th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education (pp. 182–188). held in January 2002 at University of Natal, South Africa.

Ogunniyi, M. B. (2007). Teachers' stances and practical arguments regarding a science- indigenous knowledge curriculum: Part 1. *International Journal of Science Education*, *29*(8), 963–986.

Olssen, M. (2004a). The school as the microscope of conduction: Doing foucauldian research in education. In J. D. Marshall (Ed.), *Philosophy and education series: Poststructuralism, philosophy, pedagogy* (pp. 57–84). London: Kluwer Academic.

Olssen, M. (2004b). Neoliberalism, globalisation, democracy: Challenges for education. *Globalisation, Societies and Education*, *2*(2), 231–275. doi:10.1080/1476772041000173366 5

O'Neill, A. (2015). The New Zealand experiment: Assessment driven-curriculum—managing standards, competition and performance to strengthen governmentality. Journal of Education Policy. Advance online publication doi:10.1080/02680939.2015.1033766

O'Sullivan, M. (2002). Reform implementation and the realities within which teachers work: A Namibian case study. *Compare*, *32*(2), 219–37.

O'Sullivan, M. (2004). The re-conceptualisation of learner-centred approaches: A Namibian case study. *International Journal of Educational Development*, *24*(6), 585–602.

Özerdem, A. (2007). The commodification of higher education: The pedagogical cost? In *The University of York, Forum for the Enhancement of Learning and Teaching*, Issue 16, Autumn 2006 (pp. 1–2). Retrieved from www.york.ac.uk/media/staffhome/ … /forum-16.pdf

Ozga, J., Seddon, T., Popkewitz, T. S. (Eds.). (2006). *Education research and policy – Steering the knowledge-based economy*. London: Routledge.

Patrick, F. (2013). Review Article: *Neoliberalism, the knowledge economy, and the learner: Challenging the inevitability of the commodified self as an outcome of education*. ISRN Education. [Online] Retrieved May 5, 2015. doi:10.1155/2013/108705

Pauw, C., & Malete, L. (2011). The *promise of African networks*: Internationalisation at Stellenbosch University and the University of Botswana. A paper presented at 4th European Conference on African Studies (ECAS 4) at The Nordic Africa Institute in Uppsala, Norway from June 15–18, 2011. Retrieved from http://www.nai.uu.se/ecas-4/panels/1-20/panel-6/

Piper, B., Abdi, A. A., Puplampu, K. P., & Sefa Dei, G. J. (2007). Editor's review-African education and globalization: Critical perspectives. Harvard Educational Review, *77*(1), 101.

Prophet, R. B. (1990). Rhetoric and reality in science curriculum development in Botswana. *International Journal of Science Education*, *12*(1), 13–23.
Quigley, C. (2009). Globalisation and science education: The implications for indigenous knowledge systems. *International Education Studies*, *2*(1), 77–88.
Ramorogo, G., & Ogunniyi, M. (2010). Exploring teachers' conceptions of the rainbow using an argumentation-based intervention. *African Journal of Research in Mathematics Science and Teacher Education*, *14*(1), 24–35.
Robertson, S., Novelli, M., Dale, R., Tikly, L., Dachi, H., & Alphonce, N. (2007). *Globalisation, education and development: Ideas, actors and dynamics*. London: Department for International Development (DFID).
Rollnick, M., & Rutherford, M. (1996). The use of mother tongue and English in the learning of science concepts: A classroom based study. *International Journal of Science Education*, *18*(1), 91–103.
Scholtz, Z., Braund, M., Hodges, M., Koopman, R., & Lubben, F. (2008). South African teachers' ability to argue: The emergence of inclusive argumentation. *International Journal of Educational Development*, *28*, 21–34.
Schulpen, L. (2007). Development in the 'Africa for beginners' Dutch Private Initiatives in Ghana and Malawi. Centre for International Development issues Nijmegen, Radboud University Nijmegen. Retrieved from www.ru.nl/publish/ … /schulpen2007developmentintheafricaforbeginners.pdf
Sehoole, C. (2006). Internationalisation of higher education in South Africa: A historical review. Perspectives in Education: Internationalisation of *Higher Education*: Global *Challenges, Regional Impacts* and *National Responses: Special Issue*, *4*(24), 1–13.
Smith, N., Reid, A., & Petocz, P. (2009). Representations of internationalisation in statistics education. Journal of Statistics Education, *17*(1), 1–17. Retrieved from http://www.amstat.org/publications/jse/v17n1/smith.html
Stromquist, N. P. (2007). Internationalization as a response to globalisation: Radical shifts in university environments. *Higher Education*, *53*, 81–105.
Tabulawa, R. (2003). International aid agencies, learner-centred pedagogy and political democratisation: A critique. *Comparative Education*, *39*(1), 7–26.
Tafa, E. M. (2001). Stuck in the behaviourist groove: The behaviourist teacher training model and school authoritarianism in Botswana. *Mosenodi*, *9*(2), 11–24.
Turner, J. H. (2005). A new approach for theoretically integrating micro and macro analysis. In C. Calhoun, C. Rojek, & B. Turner (Eds.), *The Sage handbook of sociology* (pp. 405–423). London: SAGE. doi:10.4135/9781848608115.n24
UNESCO. (1970). *Practical guide to in-service teacher training in Africa—Establishment, execution and control of training programmes*. Paris: Unesco.
Vaggi, G., Ventura, C., & Viezzoli, M. (2003). Inter-University development co-operation: Italian best practices. In P. Beneitone et alia (Eds.), *University development co-operation: Models of good practice, University of Deusto*. Bilbao: Humanitariannet. Retrieved from www.sviluppodeipopoli.org/ … /2-CISP-biblioteca-materialisaggi.pdf
Vavrus, F. (2009). The cultural politics of constructivist pedagogies: Teacher education reform in the United Republic of Tanzania. *International Journal of Educational Development*, *29*, 303–311.
Verger, A. (2014). Why do policy-makers adopt global education policies? Toward a research framework on the varying role of ideas in education reform. *Current Issues in Comparative Education*, *16*(2), 14–29.
Verger, A., Edwards Jr, D. B., & Altinyelken, H. K. (2014). Learning from all? The World Bank, aid agencies and the construction of hegemony in education for development. *Comparative Education*, *50*(4), 381–399.
Waast, R., & Krishna, V. V. (2003). Science in Africa: From institutionalisation to scientific free market- What options for development? *Science Technology Society*, *8*, 153–181.

Wellington, J., Handerson, J., Lally, V., Scaife, J., Knutton, S., & Nott, M. (1996). *Secondary science: Contemporary issues and practical approaches*. London: Routledge.

Welmond, M. (2002). Globalisation viewed from the periphery: The dynamics of teacher identity in the Republic of Benin. *Comparative Education Review*, *46*(1), 37–65.

White, H. (2009). Some reflections on current debates in impact evaluation—Working paper 1, International initiative on impact evaluation. Retrieved from www.3ieimpact.org/temp2.php?

Wiersm, W. (1986). *Doing research: A handbook for teachers*. London: Methuen.

Zahra, G. J. (2013). Neoliberalism, the EU and the science education in the Maltese curriculum. *[online]*. Retrieved May 5, 2015, from https://malta.academia.edu

Zeichner, K., & Ndimande, B. (2008). Contradictions and tensions in the place of teachers in educational reform: Reflections on teacher preparation in the USA and Namibia. *Teachers and Teaching: Theory and Practice*, *14*(4), 331–343.

Zughoul, M. R. (2003). Globalisation and EFL/ESL pedagogy in the Arab World. *Journal of Language and Learning*, *1*(2), 106–146.