The World of Science Education
Handbook of Research in Science Education in Sub-Saharan Africa
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Each volume in the 7-volume series *The World of Science Education* reviews research in a key region of the world. These regions include North America, South and Latin America, Asia, Australia and New Zealand, Europe and Israel, North Africa, and the Middle East, and Sub-Saharan Africa.

The focus of this *Handbook* is on research in science education in mostly former British colonies in Sub-Saharan Africa and the scholarship that most closely support this program. The reviews of the research situate what has been accomplished within a given field in Sub-Saharan Africa rather than an international context. The purpose therefore is to articulate and exhibit regional networks and trends that produced specific forms of science education. The thrust lies in identifying the roots of research programs and sketching trajectories – focusing the changing façade of problems and solutions within regional contexts. The approach allows readers to review what has been done and accomplished, what is missing and what might be done next.
The World of Science Education
CULTURAL AND HISTORICAL PERPECTIVES ON SCIENCE EDUCATION: HANDBOOKS

Volume 6

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Each volume in the 7-volume series The World of Science Education reviews research in a key region of the world. These regions include North-America, South and Latin America, Asia, Australia and New Zealand, Europe and Israel, North Africa and the Middle East, and Sub-Saharan Africa.
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PREFACE

The central goal of this *Handbook of Research in Science Education in Sub-Saharan Africa* has been to determine the nature of science education and research in sub-Saharan Africa. On the look of things, the task first seemed straightforward and one that we thought every African science educator and researcher would be eager to make some contributions to. We were so optimistic when the work started in 2011. However, it did not take long before our enthusiasm was dampened as we began to realize how arduous the task we embarked upon would soon turn out to be. Among the various challenges we faced, the greatest perhaps, was the unwillingness or lack of enthusiasm of our colleagues, especially those in the former French-speaking colonies to contribute to the project. For instance, in the early stages of this project, we made spirited efforts to contact colleagues working across the former English-French-Portuguese- and Spanish-speaking colonies based on the information we gathered from their institutions’ websites and other networks (including our previous contacts at conferences); but to our surprise, not much responses were forthcoming – even from majority of the English- and French-speaking countries. After a series of reminders, all to no avail, we refocused our attention on the few willing colleagues from the English-speaking countries. In view of this situation, we see this volume as only a first attempt which hopefully would spur more responses in later attempts to get a more robust picture of the nature of science education and research in this field in sub-Saharan Africa.

Furthermore, it is our hope that the submissions by the contributing authors, summarized in the nine chapters in this *Handbook*, would show that, with few exceptions, many of the challenges prevalent in many African countries four or five decades ago still persist, even today. These challenges include among others: paucity of qualified science teachers; poor infrastructural facilities; inadequacy in instructional materials; insensitivity of most teachers to the prevailing multi-cultural classrooms in which they teach; conflicting educational and curricular policies; large classes; examination-driven curricula and so on. It is not uncommon for science teachers to teach as much as 25 lessons or more in a week apart from the organization of practical activities in the absence of technical assistants; multiplicity of administrative commitments; poor administrative support for teachers who have been exposed to new instructional strategies; and so on. There is generally low morale among science teachers especially in some countries where teachers are poorly paid and the poor salaries are not often paid for several months, back-to-back, as a result of mismanagement of funds by government functionaries.

Despite the challenges facing science education and science teachers in sub-Saharan Africa, there have been great strides in science education research, curriculum and material development. Most countries now have curriculum and
curriculum evaluation centers where most of the personnel are Africans. However, there is still a wide chasm between curriculum policies and instructional practices. Likewise, very little use has been made of research findings – even those that have direct bearing on science teaching and learning processes. Till date, the teacher-centred and chalk-and-talk approaches are still the dominant methods of science teaching. In some cases, spurious efforts have been made to make science teaching and learning more culturally relevant to students’ life-worlds but the haphazard and crash training approaches adopted have not allowed this effort to achieve the desired goals. As a result of poor and uninspiring instructional practices, the interest shown by primary school students towards school science, as exemplified in the various Trends in International Mathematics and Science Study (TIMMS), soon wanes as these primary school students progress into the high school level. But while it is not all gloom and doom, much still has to be done by all education stakeholders – teachers, teacher educators, science education researchers, school administrators, curriculum planners, policy makers and subject advisers – to improve the quality of science education in all sub-Sahara African countries.

Femi S. Otulaja and Meshach B. Ogunniyi
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SERIES PREFACE

Science education, as science more generally, is premised on the ideology that scientific knowledge (about nature, cognition, method, methodology) is universal and that it can be taught equally well anywhere and in any context. Statistical methods in the social sciences generally and in science education more specifically are the epitome of this form of thought. However, for those who travel a lot to different countries around the world, especially when they speak several languages, it is immediately evident that not all forms of thinking are the same. In fact, one can detect cultural difference between the US and Canada even though most people living outside the North American continent often conflate the two. (Many Canadians and Americans can detect the other by the ways in which they speak and pronounce the English language.) Because of our experiences with science educators around the world, the differences in thinking, doing, and speaking science education has become quite salient to us. We therefore negotiated with Sense Publishers a series of handbooks that would take a regional focus. Such a series then would allow us to bring the regional differences into the light of day. The purpose of the series is not to explicitly work out the differences but to allow the differences to become salient in the side-by-side that the different regional volumes—each of which is spearheaded by a regional editor—will take.

After conferring with several potential regional editors, we decided to have seven volumes focusing on (a) North America, (b) Central and South America, (c) Europe, (d) Asia, (e) Australasia, (f) North Africa and the Middle East, and (g) sub-Saharan Africa. We imagined that each volume would consist of reviews of the key research foci that have characterized research in this geographical region of the world in the past 50 years or so. We therefore did not ask the editors to follow one scheme, as we expected the foci to differ according to the region. For example, there appears to be a substantive focus especially in the US on urban science education, whereas elsewhere a similar focus does either not exist or exists to a much more limited extent. It therefore makes sense to have a number of chapters focusing on urban science education in the North American volume but not in some other regions.

We envisioned that the focus could be on individual research programs and those that have most closely framed such a program. The reviews would then begin locally and situate what has been accomplished within a given field in a regional rather than international context. We envisioned that the purpose therefore would be to articulate and exhibit the regional networks and trends that led to specific forms of science education. For example, if a North American conceptual change researcher agreed to do a chapter on the topic, s/he would include the work of other scholars like Peter Hewson or John Clement, but would not include those who primarily work in a different region, for example, Reinders Duit (Germany) or David Treagust
(Australia). We knew there would not be an easy answer to the question of how to cut up the research, as there are numerous science educators who conduct research with colleagues in other parts of the world and therefore, with researchers whose work would be reviewed in a different regional volume. Thus, for example, Reinders Duit and David Treagust have a long-standing working relationship and have co-authored many papers. Would they be included in the Australasian or in the European regional volumes? We thought that such decisions could be made in a case-by-case manner. For example, the research that one of us (WMR) did in 1995 with Cam McRobbie researching physics teaching and learning in a high school in Brisbane, Queensland, would be part of the Australasian volume; however, research WMR conducted with Reinders Duit during the same year on learning physics in a German high school would be featured and reviewed in the European volume.

In the sense of getting key works included, we thought that a review would be inclusive of the most cited works and those that have shaped the field. The thrust would be on identifying the roots of research programs and sketching trajectories—focusing on the changing face of problems and solutions within regional contexts. A reader would be left with a sense of what has been accomplished and what is to be done next. We also should get a sense of the blossoming scholars within the regions of the world.

_Wolff-Michael Roth and Kenneth Tobin_

_Victoria and New York_

_June 2017_
INTRODUCTION

For a long time, all kinds of myths and prejudices concealed the true history of Africa from the world at large. African societies were looked upon as societies that could have no history. In spite of important work done by such pioneers as Leo Frobenius, Maurice Delafosse and Artura Labriola, as early as the first decade of this century, a great many non-African experts could not rid themselves of certain preconception and argued that the lack of written records made it impossible to engage in any scientific study of such societies. (Amadou-Mathar, 1990, p. vii)

The completion of this handbook on the development of and research in science education in sub-Saharan Africa has taken much longer than expected or perhaps needed. This handbook is the second to the last in a series. The volume and series editors of the handbook series had sectioned the globe into seven regions, namely: (a) North America, (b) Central and South America, (c) Europe, (d) Asia, (e) Australasia, (f) North Africa and the Middle East, and (g) sub-Saharan Africa for the purpose of producing a handbook for/in each region. Editor(s) were appointed in each region to coordinate and collaborate with other authors from their region to produce a handbook that takes a rear-view look at the trajectory of science education over the last 5 decades in their region. While the other regions were quick to the chase, Africa took a little bit longer to get into the chase; even though late in getting there, she got there and provided her story and contributions to the development of science education in the respondent countries and how research in science education is shaping knowledge production in the field of science education within each respondent country.

In the sub-Saharan Africa region, concerted efforts were made by the editors of this handbook to obtain contributions from as many African countries below the Sahara as are possible. We sought for contributions from the Eastern, Central, Western and Southern Africa countries, from Anglophone, Francophone and Portuguese-speaking and Spanish-speaking countries, with limited successes. Most
of the contributors to the chapters in this handbook are from English-speaking countries. We continue to make concerted efforts to obtain contributions from non-English sub-Saharan African countries so that this handbook can be “thickened”.

As in many regions of the world, the knowledge of how to teach and learn science is still emerging and evolving in sub-Saharan Africa. Sub-Saharan Africa is making great strides in trying to catch up with new developments in this field. Efforts to overcome the hegemony of the Newtonian, Baconian and Cartesian science and the conflicts of mainstreaming Eurocentric science as the objectified truth over indigenous knowledge is still deeply engrained in the science being taught to African students in many sub-Sahara African countries, post-independence. Hence, this handbook reflects many of the tensions faced by education reformists, science education researchers, teachers, students and learners of science subjects in post colonial countries.

It is, therefore, our hope that this handbook provides some insights into the complex nature and diversities of development and trajectories in science education in the context of the various stages of pre-colonial, colonial and post-colonial sub-Saharan Africa. As you can see, there is no one-size fits all as sub-Saharan Africa is not a homogenous group of people or communities.

SYNOPSIS OF THE CHAPTERS

This handbook starts with the exploration of science education development in the Gambia in Chapter Two. Gambia is one of the smallest countries in sub-Saharan Africa. She is located in an area of land surrounding the Gambia River and is herself surrounded by the country of Senegal, except on the west coast where it is bordered by the Atlantic Ocean. In this chapter, Kabba Colley traced the development of education, science education inclusive, through three eras of sub-Saharan Africa’s (Gambia’s) development, namely: pre-colonial, colonial and post-colonial eras. He discussed the pre-colonial and colonial eras, and then provided a proposed model to fast-forward the progress of science education into the post-colonial era. The author leaned heavily on available official records and online databases, especially on the seminal works that van Sertima (1998) did in detailing the accomplishments of African people in areas of science (and concomitantly in science education as Africans must have taught or apprenticed each other) in this region before the advent of the Whiteman. “The Senegambia region of West Africa, which was part of the great empires of Ghana, Mali, Songhai and others, was a center of cultural, scientific and technological revolution before AD1000 and was heavily impacted by the two historical events and continues till today”, cited the author.

This chapter also gave some details on the introduction of formal schooling led by Christian missionaries in Gambia during the colonial era after which the colonial government took over control and expanded schooling to all Gambians. “However”, as the author indicated, “the science curriculum implemented in colonial schools could best be described as very rudimentary and teacher-centered. The teachers’ and students’ surroundings were the main source of scientific knowledge and experience”.
The author posited that “[d]uring the colonial period, science teaching and learning focused mainly on subjects such as nature study, gardening and hygiene”. The post-colonial period witnessed continued interests in educational reforms with specific mention of the need to improve teaching and learning of science and technology. In this endeavor, the author proposed a Project-Based Science Instruction (PBSI) model and he defended his choice for science education, delineating his assumptions and its possible limitations within the context of the Gambia.

Chapter Three is a very interesting chapter as Marissa Rollnick traced the history of the formation and development of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE), as a regional organization, and that of the South African Association of Science and Technology Educators (SAASTE), a national organization, in a climate of change following the demise of apartheid in South Africa and in the unfolding post-independence context. Organization of professional bodies that would represent subject teachers, in South Africa, started with the Association of Mathematics Educators of South Africa (AMESA) and later the South African Association of Science and Technology Educators (SAASTE), followed by the Southern African Association for Research in Mathematics and Science Education (SAARMSE); SAARMSE later became the SAARMSTE, in 2000. The author traced how the formation of the National Education Crisis Committee (NECC), in 1986, led to the formation of both the Science Commission (SC) and the Mathematics Commission (MC). While the SC did not last long, the MC was very active and soon began negotiating for unity with the former (up till 1978) all-White Mathematics Association of South Africa (MASA) in 1991. In July 1993, AMESA, a single mathematics teachers’ organization, was formed.

The author informed that the science community in South Africa had organized itself into two professional, mostly White-dominated, communities, namely: the South African Association of Teachers of Physical Sciences (SAATPS) and the South African Association of Teachers of Biology (SAATOB), both of who focused on senior secondary sciences. She traced the evolution of SAASTE as an organization before embarking on that of SAARMSTE as the histories of MASA and SAASTE were interlinked. The author also gave detailed information on how various activities prepared the way forward culminating in the workshop held in the Drakensberg Mountains in January of 1992; that workshop gave birth to one collective organization (SAARMSTE). SAARMSTE is responsible for promoting mathematics, science and technology education and created room for participation, not only from South Africa, but also other southern African countries that had provided homes for those in exile during the apartheid days from where they have accumulated knowledge that can be shared with other academics.

Marissa went on to discuss the structure of SAARMSTE, the conferences and the various landmarks in the organization’s development, including journal publications, capacity building through the yearly research schools. She ended the chapter by detailing the impact of SAARMSTE throughout the twenty-one years of her existence.
In Chapter Four, Oyelekan and Omiwale discussed the trends of science education in Nigeria within a global context. They traced the history and development of education in Nigeria, particularly in the western part from the days of the missionaries through many of the education reforms and curricular innovations and transformations. They discussed the Ashby Commission that pre-dated independence in 1960 and the various other post-independence efforts to reform education as the country attempted to sustain itself educationally, economically and politically. They delineated the reform projects and programs that formulated various science education curricular and material developments for use at the primary and secondary school levels including the recent Universal Basic Education (UBE) policy implementations. The authors took readers through the trends in science education research in Nigeria. They ended the chapter with tips on the future of science education in Nigeria.

Chapter Five by Tony Lelliott provides insights into how science is being communicated or disseminated (shared) in Africa and the possibilities and opportunities for informal science learning. Using Africa’s participation in the biennial Public Communication of Science and Technology (PCST) conference as his unit of analysis, Tony placed emphasis on the importance of science communication with the goals of increasing/improving scientific literacy. To buttress this point, the author provided comparisons of sub-Sahara Africans’ participation at conferences such as the African Science Communication Conferences (ASCC) and the PCST and he discussed the relevance of the topics presented by representatives from different African countries. He interrogated the contestation of what scientific literacy is as indicated in published literature by various non-Western authors who challenged the universality of scientific literacy. Linking scientific literacy to informal science learning, Tony contended that “there is little evidence of research into informal science learning in most of sub-Saharan Africa”. He then went on to show that concerted efforts are being made, especially in South Africa, to study the use of museums and science cafés as opportunities for informal science learning.

In Chapter Six, Mhakure and Otulaja advocated for inclusion of indigenous knowledge systems (IKS) in science education as an opportunity to shift ontology and traditional ways of teaching to more culturally-responsive pedagogy. After comparing IKS to westernized science, the authors discussed the implications of integrating IKS and Western Science Knowledge (WSK) in the sub-Sahara African science classroom, especially in light of the South African National Curriculum that advocates for the teaching and learning of IKS and WSK in the classroom. Building on these, the authors discussed the use of argumentation as an instructional model for changing the methods of teaching and learning so as to catalyze integration of IKS and WSK. They then gave examples where such model has been engaged in teacher, research and academic development at a South African University.

Chapter Seven, authored by Mussa Mohamed and Simon Karuku, provides readers with historical perspectives on educational, hence science education, development in mainland Tanzania. The authors were quick to point out that whatever happens to education on the mainland is replicated on the three other Islands of Zanzibar, which
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is the largest, Pembe and Mafia. As in most other chapters in this book, the authors traced the developments of education from before the country’s independence to after independence with focus on post-independence educational and curricular reforms. They discussed the policies and politics of educational reforms, from indigenous education to the Arab incursion followed by those associated with the advent of missionaries who wanted to Christianized the Africans piggy-backed by hegemonic education under colonialism of the Germans and the British. Political independence, as they indicated, marked the end of the segregationist educational policies of the British and the beginning of various attempts and struggles by the independent nation to reform and indigenise her education system, including science education. The authors critiqued the current competency-based curriculum (CBC) which the government has been trying to implement and its implications in the classroom.

In Chapter Eight, Paul Webb provides readers with another angle on scientific literacy focusing on the issues of language in South Africa. He discussed the persistent tensions resulting from the dominance of the English Language as the language of teaching and learning, the language-in-education policy, parental preferences, additive bilingualism, multilingualism, code-switching, mother tongue, and the language of the discipline as they affect scientific literacy in the African context, particularly in South Africa. He also brought into account the consideration for including indigenous knowledge.

Chapter Nine, authored by Mukundu, Chineka and Madzudzo, provides insights into science education, training and research in Zimbabwe. The authors discussed the structure of colonial and post-colonial Zimbabwean education system. As indicated in other chapters in this handbook, these authors gave the reader a synopsis of the education system pre- and post-independence, focusing more on post-independence curricular and education reforms and policy changes. The authors alluded to the common dilemma of most African countries coming out of colonial rules, whereby the new government massively expand access to education, often declaring primary education as basic human right and making it free and compulsory, only to struggle with poor and inadequate infrastructures, learning material resources and inadequate supply of well-trained teachers. They took the reader through series of programmatic changes focusing on science education, science teacher preparation and professional development as fundamental to teaching and learning and sustainability in/of science. They discussed marginalization and gender issues in science education in Zimbabwe and the challenges of the language policy in education with the need to develop indigenous Africa science. The chapter ended with issues related to the current level of educational funding and the need to support research and development and their dissemination in Zimbabwe.

CONCLUSION

As alluded to earlier, it would have been good to have obtained a chapter each from each country in sub-Saharan Africa. This book would not have been so lean and we
would have needed to produce this book in more than one volume. We hope we can still do this as we continue to press for contributions from our French-speaking, Portuguese-speaking and Spanish-speaking countries, former Belgian colonies and other English-speaking countries that are not represented in this volume. Our hope is that your knowledge of science education development since the advent of Western invasion of African countries south of the Sahara will be enriched by the work that has been done in this volume.

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2. SCIENCE EDUCATION IN GAMBIA

An Optimistic Model

INTRODUCTION

The teaching and learning of science in the Gambia is not well documented. However, there are past and present records collected by government, non-governmental and international aid agencies that capture various aspects of science education in the Gambia. The challenge is reviewing the available records and piecing them together to tell a coherent story about science education in the Gambia. The purpose of this chapter is to critically examine the records on science education in pre-colonial, colonial and post-colonial Gambia, and propose a model for advancing the field in the twenty-first century. The chapter is divided into four sections. The first three sections explore science education during the three different historical epochs, while the fourth section focuses on the proposed model, its assumptions, implications and limitations. The methodology used for this chapter is research synthesis (Sadler et al., 2010; U.S. General Accounting Office Program Evaluation and Methodology Division, 1992) and the data source consisted of official government records, online databases from UNESCO, Educational Research Network for West and Central Africa (ERNWCA), African Education Research Network (AERN), The African Union (AU), Economic Community of West African States (ECOWAS), books and refereed journal articles.

SCIENCE EDUCATION IN PRE-COLONIAL TIMES

Before we begin, it is important to define what we mean by pre-colonial Gambia. This is because the word could be subjected to different interpretations depending on an author’s point of view. In this chapter, the word “pre-colonial Gambia” refers to the period before AD 1000. This is a period before Europeans arrived and settled in Gambia. The earliest record of European activity in Gambia is dated at 1455, when the Portuguese, Dutch, French and the English competed with each other for the riches of the Gambia River (Davidson, Buah & Ajayi, 1977; Gray, 1966; Gailey, 1965). Before AD 1000, there are virtually no written records on science education in “pre-colonial Gambia”. Western education, as we know it now, did not exist. However, there existed an indigenous education system that fostered the development of character and skills in leadership, trade, fishing,
farming, hunting, cottage industry, music, art and crafts. Opportunities for science teaching and learning came in two forms; family-based schooling and community apprenticeships. Family-based schooling was characterized by learning of science through informal observation of the child’s environment and active participation in day-to-day activities. For instance, children learned the basic principles of biology by observing the life cycles of plants and animals during the rainy season when there is a great diversity of plants and animals because of the optimum environmental conditions (e.g. water supply, favorable temperatures and abundance of food) that favored growth and reproduction. During the dry season, the opposite is true and the children learned about the change in seasons and its effects on the environment and life in general. In addition, they learned about astronomy while watching the night skies and listening to stories told by their elders. They learned about systems of measurement by relating weights and quantities to common household objects, by using the distance between the human thumb and index finger, and the length of the arms as units for measuring length, width and height, and by using the length of one’s foot and the pace between the two feet as units to measure distance and area. With regards to community apprenticeships, opportunities for science teaching and learning allowed older children or youths to spend extended amounts of time studying under a master to learn skills in iron work, blacksmithing, tool-making, carpentry, building construction, boat building, fishing, rice cultivation, weaving, cloth-making, beekeeping and livestock keeping. Although this could easily be referred to as vocational education when one takes a Eurocentric interpretation, in the Gambian context, most learning was applied and the focus of education was to enable the child to function and serve his/her society. In the process of learning about skills, the youth learned underlining concepts, principles and natural laws governing the universe.

Although records of science education in pre-colonial Gambia are not available, the prehistory of Africa reveals that Africans have indeed been involved in the history and development of science since time immemorial. The contributions of Africans to science have been documented by historians and scientists such as Van Sertima (1998), Diop (1987, 1987a), Davidson (1992), Ki-Zerbo (1989). In their work, these scholars provided examples of Africans’ engagement in scientific activities and the application of science (technology) to transform their societies. For instance, in discussing the development of scientific techniques in pre-colonial Africa, Diop (1987) noted:

From Nubia to Senegal, still along the same latitude, which seems to belong to the same area of civilization, active blast furnaces produced the iron required for technological and economic activity. It is almost certain that wood were the fuel used. The use of metallurgy in Black Africa dates back to time immemorial. Mining of ore, smelting of metal, and working with it were not taught to Africans by any foreigner. (p. 204)
Cheikh Anta Diop (1987) went on to provide more examples of scientific techniques invented by Africans in other fields. He writes:

Empirical medicine was quite developed in Africa. Here as in ancient Egypt, a family practiced a single branch of medicine on a hereditary basis. One was specialized in the eyes, the stomach and so on. Empirical toxicology was highly developed, whence the efficacy of the poisoned arrows was used in warfare. They were covered with snake venom or sap of poisonous plants. The use of soap, connected with the rise of urbanism, created a level of hygiene quite remarkable for this period” (pp. 205–206). In terms of arts and crafts, “The treadle loom, a local invention, was known to Africa, as well as the Yoruba vertical loom; with them may be woven fairly narrow strips of fabric, variously decorated, which can then be assembled into loincloth or other articles of clothing... Basket-weaving, ceramics, and dyeing were highly developed crafts. The same was true for shoemaking, thanks to plants such as the neneb, which could be used in tanning skins, particularly goatskins. (pp. 206–207)

Van Sertima (1998) discussing the lost science of Africa, provided several examples of scientific and technological contributions Africans have made in the area of metallurgy, astronomy, mathematics, architecture and engineering, agricultural science, and medicine, navigation and writing systems. It is beyond the scope of this chapter to discuss all the examples. However, the examples he provided in agricultural science and medicine are very instructive and worth noting here. With regards to contributions of Africans to the agricultural sciences, Van Sertima (1998) writes:

The earliest technological leap from hunting and gathering activities to the scientific cultivation of crops occurred in Africa at least 7,000 years before it did on any other continent. Science magazine reported in 1979 the discovery by Fred Wendorf of agricultural sites near the Nile going back more than 10,000 years before the dynasties of Egypt. There, Africans were cultivating and harvesting barley and einkorn wheat. Grains of these cereals were carbon-dated at Kubbaniya, a site just few miles north of Aswan, and these gave a reading of 17,850 B.C. plus or minus 200 years, which is roughly 17,500–18,000 years ago. (p. 20)

Our African ancestors did not stop at the cultivation of crops alone. There is evidence that in the Highlands of Kenya they domesticated cattle 15,000 years ago. Van Sertima describes how the technologies of crop production and animal husbandry diffused to other regions of the world through migration of people. He also noted that desertification of the fertile Sahara was a major factor in the migration of African peoples from Western Africa to the Nile, Euphrates and other areas beyond. The contributions of Africa to medicine are remarkable when one considers the period and context. Van Sertima reminds us of the role of African herbal medicine and how the Bantu-speaking peoples used the bark of the specie Salix capensis to treat musculoskeletal pain long before aspirin was invented. Later on it was found that
this family of plants contains the ingredient salicylic acid, which is used in aspirin. He cited other examples in the field of medicine, as in Mali where kaolin was used to treat diarrhea, and in Nigeria where a traditional doctor used a preparation from the root of a *rauwolfia* in the treatment of psychosis. As it turns out, this plant, which belongs to the family *Apocynaceae*, contains the drug reserpine (an alkaloid), which is used in Western countries as a tranquilizer and in the treatment of hypertension. Van Sertima continues and provides this very interesting case on the practice of surgery and Caesarean operation:

The most impressive of these is a Caesarean operation performed by Banyoro surgeons in East Africa. It was witnessed and sketched by Dr. Felkin in 1879, at a time when such operations were rare in Europe. The skill demonstrated in this operation startled readers of the Edinburgh Medical Journal where it was reported. The Africans were not only found to be doing the Caesarean section with routine skill, but to be using antiseptic surgery, which Lister pioneered only two years earlier than this event. (p. 23)

It was not only in the fields of metallurgy, agricultural science and medicine that earlier Africans made their imprint, John Pappademos (1998) argued that Africans also contributed to the early beginnings of the field of physics:

The history of physics must surely go back to the very origins of human society, as evolving humans began to solve problems of gathering and producing food, shelter and clothing. The first thought-out dynamic experiments must have been done in relation to the development of throwing devices for spears, and in inventing the bow and arrow—the first devices utilizing the principles of stored mechanical energy and converting it to kinetic energy. The practical mastery of the principles of mechanics—the oldest branch of physics—grew as man learned to make flint weapons, tools, dwellings, boats, etc.

It is in this light that the total exclusion of Africans from the history of physics appears the most astonishing. Anthropological evidence shows that the origin of man is to be found in Africa. It was in Africa that man firsts started up along the tool-making path that distinguishes him from the lower forms of life. (p. 180)

The inference from the above statement by Pappademos is that our African ancestors, like humans everywhere, were engaged in all sorts of scientific activities as they experimented with different ways of hunting and gathering. Although, when we use our institutionalized definitions of science, we may not consider such activities as scientific, based on their epoch and context, one could argue that African ancestors were engaged in science because they designed and tested materials and tools, they identified, classified and bred plants and animals, they applied principles and technologies to solve problems, they developed complex systems of infrastructure that helped them survive uncertain climatic conditions and natural calamities. As
they discovered new ideas and principles, it was possible for them to develop more advanced societies. Modern, western-based physics did not suddenly start with ancient Greece or the scientific revolution in Europe that gave us Archimedes, Copernicus, Galileo, Newton, Faraday and Einstein, to name a few. Modern, western-based physics owes much of its origins to this prehistoric “savannah land physics”.

According to Dennick (2002), “Throughout European history since the Renaissance, there has been a tendency to disparage and downgrade the discoveries and achievements of other cultures, and historians have been very prone to give credit where it is not due” (p. 104). The transatlantic slave trade and colonization of Africa, not only impacted economic and social development of the continent, but also the scientific development of the continent. The Senegambia region of West Africa, which was part of the great empires of Ghana, Mali, Songhai and others, was a center of cultural, scientific and technological revolution before AD 1000 and was heavily impacted by the two historical events and continues till today. Amadou-Mathar M’bow (1990), the former Director General of UNESCO, summed it up in the following words:

For a long time, all kinds of myths and prejudices concealed the true history of Africa from the world at large. African societies were looked upon as societies that could have no history. In spite of important work done by such pioneers as Leo Frobenius, Maurice Delafosse and Artura Labriola, as early as the first decade of this century, a great many non-African experts could not rid themselves of certain preconceptions and argued that the lack of written records made it impossible to engage in any scientific study of such societies. (p. vii)

Another phenomenon which did a great disservice to the objective study of the African was the appearance, with the slave trade and colonization, of racial stereotypes which bred contempt and lack of understanding and became so deep-rooted that they distorted even the basic concepts of historiography. (p. viii)

SCIENCE EDUCATION IN GAMBIA DURING COLONIAL TIMES

The British arrived in the Gambia in the 1600’s and did not leave until 1965. After much rivalry with the Dutch and the French, the country officially came under the control of the British (Gray, 1966). From the mid-1600’s to 1965 the British controlled and/or ruled the Gambia, which comprised the Gambia River and all the land surrounding it, stretching from the Atlantic Ocean in the west to 470 kilometers or 292 miles in the east or up river. During this period, very little was done to develop the education system in the country.

Formal education system was established by missionaries from the Society of Friends in London, who arrived in the capital, Banjul (formally called Bathurst) to carry out missionary work (Gray, 1966). The story behind the arrival of the Society of Friends in the Gambia was best summed up by Gray (1966) in the following words:
In actual point of time the first missionaries to arrive in the Gambia belong to the Society of Friends. Though this particular mission did not labor long in the country, its work deserves something more than mere passing mention. William Singleton landed at Bathurst on January 1821. He was sent out under the auspices of a number of Friends, who had interested themselves in two natives from Goree and the Gambia respectively, who had arrived in London on a sailing ship. Singleton and a few other Friends had these two persons educated in England with the express object of utilizing them as assistants to a party of missionaries, whom it was proposed to send to the Gambia. (p. 311)

The head of the mission was Mrs. Hannah Kilman, the widow of John Wesley, founder of the Methodist New Connection. Mrs. Kilman and the sisters of her party settled in Banjul, where they opened up a girl’s school. They taught the scripture, reading, writing, cookery and needlework. The brothers of the mission started a boy’s school in Cape St Mary and instructed their students in plowing and other farming techniques. The Sisters of Friends were followed by the Methodist, Anglican and Roman Catholic Missions respectively. The latter two missions opened up schools in the Upper River Division (URD) of the country. Gambia is divided into five administrative divisions; the URD is located in the interior of the country about 280 miles from the capital.

Rodney (1972) noted that Christian missionaries were as much a part of the colonizing forces as were explorers, soldiers and traders. The aim of Christianity in Africa was, therefore, not only to convert Africans into Christians, but also to inculcate western values in them. Teaching of reading and writing of the English language was part and parcel of Christian education. However, the lack of financial support from the colonial government for public education led the missionaries to dominate the education landscape in the Gambia. In 1927, the Colonial Government established Armitage School to create an institution for the sons and daughters of chiefs, who sometimes nominated other children. A Department of Education was set up shortly afterwards in 1930 to administer grant-in-aid and inspect mission schools. This was followed by the establishment of the Education Ordinance of 1945. The purpose of the Ordinance was to regulate education in the country. It provided for the establishment of a Board of Education, which consisted of twelve nominated members and four ex-officio members. The nominated members consisted of one member from the Legislature, three representatives from the Anglican, Methodist and Roman Catholic Mission respectively, one Gambian representing the Muslim community, two Gambians representing the rural areas (then called the Protectorate), one Gambian representing the Gambian Teachers and four nominated by the Governor. Out of the four nominated by the Governor, two were selected to represent women’s education. The four ex-officio members were as follows; the Senior Education Officer, the Assistant Director of Medical Services, the Senior Commissioner and the Senior Agricultural Officer. The main function of the Board
was to advise the Governor on issues pertaining to educational policy in Gambia (Colonial Office, 1947).

In addition to the Department of Education, the Colonial Government also established the District Authority Schools (DAS). The goal of the DAS was to spread formal education to the rural population. Enrollment was open and there was no entry age (Republic of the Gambia, 1976). Parents were asked to pay a school fee of D2.50 ($0.08). The dalasi is the Gambian currency, abbreviated as D. The educational system consisted of a three-year infant course, seven-year primary and three-year high school. However, due to the fact that most of the inhabitants of the rural areas were Muslims, the demand for schooling was lower in the rural areas than in the capital, Banjul. In addition, funding for the building of new schools and hiring of teachers was limited. The DAS were financed mainly from District funds.

In 1961 the Colonial Office created its first education policy designed to harmonize and make basic education accessible to all Gambian children (Colonial Office, 1964). The main elements of the policy were the establishment of an entry age of six years and the introduction of a six-year primary education course for all children. In addition, it included plans to build more schools in the rural areas and give more attention to girl’s education. A review of the education statistics three years after the implementation of the 1961 education policy showed that Government primary schools increased from 40 in 1961 to 50 in 1964. However, enrollment for boys was 69.8 percent, while that of girls was 30.2 percent (Colonial Office, 1964).

Studies on the teaching and learning of science in the colonial schools are hard to come by. However, the science curriculum implemented in colonial schools could best be described as very rudimentary and teacher-centered. The teachers’ and students’ surroundings were the main source of scientific knowledge and experience. The role of the teacher was to lecture and write terms and concepts on the “blackboard”, while students listened and took notes. Science instruction was guided by textbooks written by foreign authors, based on foreign context, and adapted for Gambian schools. This system of education was not unique to the Gambia, but practiced throughout the colonized world. Freire (1970, 1993, 2000) who has studied this system of education and its implementations for the liberation of oppressed peoples, called it “banking concept of education” (p. 72). In his book, *Pedagogy of the Oppressed*, he wrote:

> Education thus becomes an act of depositing, in which the students are the depositories and the teacher is the depositor. Instead of communicating, the teacher issues communiqués and makes deposits which students patiently receive, memorize and repeat. This is the “banking” concept of education, in which the scope of action allowed to the students extends only as far as receiving, filing, and storing deposits. They do, it is true, have the opportunity to become collectors or cataloguers of the things they store. But in the last analysis, it is the people themselves who are filed away through lack of
creativity, transformation, and knowledge in this (at best) misguided system. For apart from inquiry, apart from the praxis, individuals cannot be truly human. Knowledge emerges only through intervention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other. (p. 72)

During the colonial period, science teaching and learning focused mainly on subjects such as nature study, gardening and hygiene. In nature studies students were taught about the life cycles of common plants and animals. For instance, studying the structure and function of a typical green plant, students learned about seed germination, the root system, the shoot system, leaves and flowers. In addition, they learned about the life cycles of common insects such as the butterfly and non-living things such as rocks. Most schools were required to have a garden to teach students about basic principles of agriculture. School gardens provided an opportunity for students to learn about the characteristics of the soil and how to grow vegetables. Each week a double period (about 90 minutes) was spent on gardening where students learned how to prepare the soil, how to plant seeds, how to water and care for the crops. They also learned the common and scientific names of the different types of crops and livestock. Throughout the school term, students worked in groups to tend crops on beds or small plots of land. In some schools, students with the best beds were awarded prizes at the end of the school year. With regards to hygiene, the focus of science learning was on the parts of the human body and their functions. In addition, students learned about causes, treatment and prevention of common illnesses such as malaria, common cold and diarrhea. The study of hygiene also included learning about, cleanliness, germs and parasites that caused diseases to humans. Most of the teaching was textbook-based and the main method was chalk-and-talk. There was no general science, no biology, no chemistry, no physics, no earth or environmental science and no mathematics, as we know it today.

SCIENCE EDUCATION IN POST-COLONIAL GAMBIA

In 1965, the Gambia became independent from Britain and, like most newly independent nations, the Gambian Government embarked on a series of development programs. It requested UNESCO’s educational planning unit to assist in the development of a 10-year education plan for the Gambia (Sleight, 1966). The development plan, which is often referred to as the Sleight Report, named after its author, became the blueprint for the development of education in the Gambia from 1965–1975. The Sleight Report on education recommended that enrollment in primary schools should be 30,000 by 1975. In addition, it noted that 24 classrooms were to be built in Banjul and 180 in the rural areas during the period 1965–1970. The new school buildings were to be built out of local materials and bilateral aid used to purchase materials that are not produced locally. A school building unit was to be established and staff quarters for teachers were to be erected. Revision of the
primary curriculum was to be undertaken and the school year adjusted to meet the needs of the rural population. Teacher supervision and in-service training was to be provided as well. Although revisions to the curriculum were to be undertaken, no specific mention was made about science teaching and learning.

In 1976, the Government of the Gambia (GOTG), realizing that its previous educational development programs were not achieving their desired objectives, formulated a new national education policy, called *Education Policy 1976–1986* (Republic of the Gambia, 1976). This policy differed from previous policies and plans in that it covered not only primary, but also secondary and post-secondary education. It provided for non-formal education, agricultural, vocational, technical and religious education. In addition, it proposed the primary school science curriculum will be “…an integrated course planned to embrace everyday science, simple phenomena, agriculture, health and sanitation, and their application to growth and development, and to the environment” (Republic of the Gambia, 1976, p. 3). At the secondary level, the new policy proposed to change the designation of schools from senior secondary schools to high schools and junior secondary schools to secondary technical schools. The high school curriculum was to follow the General Certificate of Education “Ordinary level” Examination administered by the West African Examination Council, while the secondary technical school curriculum was to be based on agricultural and vocational education. Data on the implementation of the *Education Policy 1976–1986* and its impact on science education in the Gambia are hard to come by and can only be inferred from official records or reports.

One of the main benefits of the policy was that it made education free, but not compulsory for all children. The declaration of free primary education created high expectations from parents. It led many people to believe that everyone would have a free education. In actual fact, there were not enough schools to absorb the school-going population. Furthermore, there were not enough teachers and resources (chairs, desks, textbooks, writing materials, etc) to support the education system. As a result of the increase in enrollment coupled with limited resources, the quality of education begins to decline. This issue is not unique to the Gambia. In fact, a recent study of UK aid to education in three East African countries noted that the “rapid expansion of enrolment has led to a decline in educational outcomes. Expanding access to more remote rural areas pushes up unit costs, while management systems become progressively weaker. The countries have been forced to recruit less qualified teachers – sometimes with little more than basic education…Many children are reaching the end of primary school without achieving basic levels of literacy and numeracy” (Independent Commission for Aid Impact, 2012, p. 12).

In 1987, the government convened its First National Conference on Education to discuss the worsening education crises in the Gambia. The conference was attended by various education stakeholders, representing teachers, students, parents, administrators, policy makers, religious organizations, parents, private companies, various government departments, non-governmental organizations and donor agencies. The main issues discussed at the conference were educational access,
the shortage of qualified teachers, the role of secondary technical schools, non-formal education, examinations, curriculum, language policy and education of girls. At the end of conference, several working groups were formed and the work of these groups culminated in the formulation of the second ten-year education policy, *Education Policy 1988–2003* (Republic of the Gambia, 1988). The *Education Policy 1988–2003*, laid out new aims, objectives and strategies for the education system. It incorporated most of the issues and concerns raised at the First National Education Conference. In addition, for the first time, the financing of education was given serious discussion. To implement this second ten-year education policy, the government turned to the World Bank, which agreed to provide a loan of $14.6 million. As part of the agreement between the GOTG and the World Bank, the former agreed to restructure its whole education system from a British system to an American system (World Bank, 1990). Below is comparison of past and present education systems in the Gambia.

<table>
<thead>
<tr>
<th>Period</th>
<th>Education system</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 1965</td>
<td>3-7-3</td>
<td>Three-year infant course, followed by a seven-year primary course, followed by a three-year high school course leading to Cambridge School Certificate.</td>
</tr>
<tr>
<td>1965–1992</td>
<td>6-5-2 or 6-4-2</td>
<td>Six years of primary school, five years of high school and two years of college preparatory. Or six years of primary school, four years of technical school and two years of vocational training</td>
</tr>
<tr>
<td>1992–2004</td>
<td>6-3-3-2</td>
<td>Six years of primary school, three years of middle school, three years of high school and two years of college preparatory</td>
</tr>
<tr>
<td>2004–Present</td>
<td>9-3-4</td>
<td>Nine years of basic education (grades 1–6 lower basic and grades 7–9 upper basic), three years of senior secondary education and four years of tertiary or higher education</td>
</tr>
</tbody>
</table>

In the *Education Policy 1988–2003* (Republic of the Gambia, 1988), the Government outlined some of its achievement in the previous policy, but also acknowledged that there were challenges ahead. In the area of science education, the policy was vague (science was only mentioned as part of a list of subjects to be taught). There was no mention of science teaching or science learning except in few areas as it related to the overall school curriculum. For instance, in the Section 4.20 (Curriculum) of the policy it noted:

In furtherance of the underlying principles and aims for school education in the Gambia, (see Section 3.1–3.6), it is proposed that the curriculum for grades 1–6
should include National Languages (Mandinka, Wolof & Pulaar), which should be medium of instruction for grades 1–2 and taught as subjects from grade 3 onwards; English, which should be taught as a subject from grade 1 and become the medium of instruction from grade 3; mathematics, general science; social studies; home economics; physical and health education; arts and craft including local crafts; music, religious education and family life education. (p. 17)

The Policy went on to say that at the middle school level, the curriculum would be broadened to include foreign languages such as French and Arabic. In addition, pre-vocational and commercial studies, science and technology, social and environmental studies and agricultural science and literature will be added. The Education Policy 1988–2003 noted “The Gambia Common Entrance Examination will be replaced by a Primary School Leaving Certificate at the end of grade 6 and a Middle School Leaving Certificate at the end of grade 9 in conformity with new trends in West Africa” (p. 19). With regards to the high school curriculum, the Policy noted the same course of study introduced at the middle school level but emphasized that their treatment will continue to expand.

The implementation of Education Policy 1988–2003 ushered in various developments or reforms in science education in the Gambia. For instance, a Curriculum Development Center was transformed into a Curriculum Research, Evaluation and Development Directorate. The Directorate established subject panels consisting of various stakeholders to review, revise and develop curriculum frameworks, guides, syllabi and provide professional development for teachers on how to use these instructional materials. It also encouraged and supported the publication of science textbooks that are relevant and appropriate for Gambian students, authored or co-authored by Gambian writers.

To determine the quality and relevance of the education system, benchmarks for student learning outcomes and a national assessment system (National Assessment Test) for grades 3 and 5 were established during the Education Policy 1988–2003 period. However, the 2008 results of the National Assessment Test indicated that only 36 percent of grade 3 students (18% male and 18% female) and 24 percent of grade 5 students (13% male and 11% female) passed the mathematics test (see Table 2.2). With regards to the science test, only 35 percent of grade 5 students (19 % males and

<table>
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<tr>
<th>Subjects</th>
<th>Grade 3</th>
<th>Grade 5</th>
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<tr>
<td></td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>Mathematics</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Science</td>
<td>19</td>
<td>16</td>
</tr>
</tbody>
</table>

16% female) passed the test. No data was reported for the grade 3 students on the science test. An earlier study by the UNESCO Monitoring of Learning Assessment (2012), found that:

The overwhelming majority of pupils did not achieve mastery of 70%. Private schools performed better that Mission and government schools. The mean score for English were 81.1% for private, 46.3% for Mission and 36.7% for government schools, whereas for mathematics, the corresponding mean scores were 72.3%, 44.3% and 38.9%, respectively. Similar trends were established in social and environmental studies, and science. Urban pupils also outperformed the rural pupils in all achievement tests. Boys also outperformed girls in almost all tests. (p. 19)

Recognizing the limitations of earlier education policies in addressing the challenges of science education, the GOTG in its third ten-year education policy, Education Policy 2004–2015 (Republic of the Gambia, 2004) stated.

The Science and Technology Education (STE) policy will be pursued to ensure that there is development of a strong science and technology commencing at the basic level to the development of in-country based research scientists and engineers at tertiary and higher education level.

The disappointing outcomes in science and mathematics education, led the GOTG to come up with a new strategy for science and technology education. This strategy involves the following:

- Train 100 mathematics and science teachers every year using the bridging gap approach
- Provide math and science students with a bigger stipend at the Gambia College, after testing achievement levels as a requirement
- Pay 50% of basic salary to all science and mathematics teachers in upper basic and senior secondary schools, after testing content knowledge and pedagogy as a requirement
- Train 50 Grade 12 students to be lab technicians and assistants
- Provide in-service training for 100 mathematics and science teachers every year
- Provide training for 25 Information Communication Technology (ICT) teachers every year
- Train 100 mathematics and science teachers in ICT every year (Republic of the Gambia, 2008, p. 55)

In addition, the GOTG agreed to work towards the achievement of following objectives:

- The motivation of students’ interest in mathematics, science and technology by the provision of scholarship packages, including improvement in the teaching of science
• Establishment and promotion of science and technology clubs and activities in schools
• Celebration of the National Science and Technology Week
• Extramural classes for mathematics and science students in secondary schools
• Annual girls’ science and mathematics clinics and camps
• Provision of adequate and appropriate laboratory apparatus and other teaching/learning materials for science
• Refurbishment of science labs in schools
• Construction of labs for Lower Basic Schools (LBS)
• Procurement of chemical reagents and distribution to schools
• Provision of micro-science kits to LBS
• Development of improvised prototypes of laboratory apparatus and equipment for secondary schools
• Capacity building for STE providers, administrators and policy-makers
• Training and retraining of science teachers in the light of new demands, including training of UTG and other higher education staff
• Provision of special incentives and allowances to this cohort of teachers
• Integration of ICT in the training of science teachers, in subject teaching/learning, in management/administration of the education sector
• Use of ICT and distance learning methods and technology to improve access, equity and quality of STE and other subject areas as appropriate
• Introduction of Educational Broadcasting Service (EBS) (radio, TV and online where possible) to support teaching/learning processes both in and out of the school setting
• Greater involvement of girls and women in STE
• Greater involvement of the private sector as well as the local community in STE

The targets in the realization of these strategies may include the following:

• Provide scholarships for 50 students nationwide at secondary level
• Provide seed money to establish 50 science and technology clubs in schools
• Annual celebration involving all schools in the host region
• Provide 300 students with extramural classes every rainy season holiday in mathematics and science
• Organize mathematics and science clinics for 50 girls per region annually
• Refurbish and procure chemical reagents for 5% of labs per region annually
• Provide 40% of lab apparatus and equipment prototype
• Create three labs for three LBS per region
• Provide scholarships to mathematics and science students at the UTG (Republic of the Gambia, 2008, p. 57)

Unlike previous policies, Education Policy 2004–2015 is very clear about the Government’s intentions for science education. Since the policy was released, the science education community in the Gambia has become energized. The Government
with the help of international donor has established professional development programs to upgrade the knowledge and skills of science and mathematics teachers (World Bank funded Progressive Science Initiative (PSI) and Progressive Mathematics Initiative (PMI), http://localtalknews.com/state/education/1286-math-and-science-program-developed-in-new-jersey-to-be-taught-in-africa.html). In addition, the Institute of Physics, a UK-based professional scientific association, Jolerider, UK-based charity and partner schools in the Gambia have implemented teacher training workshop for physics teachers held at Sifoe Senior Secondary School in June and January 2012 (http://www.iop.org/about/international/development/education/gambia/page_53544.html).

At the local level, information available online indicates that there are innovative pilot projects being implemented to improve the teaching and learning of science such as the Fatoto Science and Environmental Ambassadors, a school-based science program designed to stimulate students’ interests in science, promote inquiry-based science learning and improve students’ science performance. The project is located at the Fatoto Upper Basic and Senior Secondary School and more information is available at http://www.gov.gm/mobse/images/stories/pdfs/FSEAs%20Newsletter_final%20copy.pdf. Similarly, the Rotary Club of Banjul, a civil society organization that has been active in supporting educational development in the Gambia, has recently embarked on a project to improve the teaching and learning of science in the Greater Banjul Area. The project involves the building and operation of laboratory facilities that could be accessed by local secondary schools that have limited or no laboratory facilities (for more information refer to Secondary Schools Science Laboratories Project, http://www.rotaryclub.gm/Rotary%20Club%20of%20Banjul%20FIN/html/science_lab.html)

PROPOSED MODEL

In this chapter, it’s been shown that although records on the teaching and learning of science in pre-colonial Gambia are hard to come by, the history of ancient Africa (which the Gambia is part of) is punctuated with examples of scientific discoveries and contributions of Africans to various fields of science. The record also shows that public education in general and science education in particular was not a priority of the Colonial Government until the 1930’s and 1940’s, when a Department of Education was established to administer grant-in-aid to schools. In addition, the chapter has revealed that from 1965–1988, the GOTG education policies did not address in any significant way, the issue of science education in pre-K-12 education. The lack of proper attention paid to science education in policy documents is understandable. As a newly independent state, the GOTG priority for the education sector was to build an infrastructure and provide access to basic education for all children throughout the country. So it could be argued that the time and conditions were not ripe to implement an agenda for science education reform in the Gambia prior to the Education Policy 2004–2015.