

Introduction

This collection is a contribution to current debates on gender, science and technology. Feminist debates and research about science can generally be put into two slots: the women question in science (that is, women's participation in sciences) and the science question in feminism (that is, the construction of feminine knowledge). The chapters in this collection deal mainly with the first—women's participation in science.

In recent years, science and technology has been widely advocated as the indisputable foundation for political and economic power in the modern world. However, science is still marked by various layers and dimensions of deep-seated gender inequality that work to the disadvantage of women. Despite the fact that a lot of awareness has been created and that gender issues are now more readily acknowledged by developers in Africa, participation in science and technology continues to remain a hurdle as far as girls and women are concerned. Half the African population is lagging behind in science and technology. This is not lost on developers, but there is presently a dearth of research to show what actually goes on in the region. UNESCO provided seminal information through its regional office for Education in Africa, based in Dakar (BREDA 1999) in a project titled 'Technical, Scientific and Vocational Training for Young Girls', which identified factors determining how positively or negatively girls were being guided into scientific and technical streams. Measures adopted by member states to improve girls' access to these streams were also identified. However, UNESCO's initiatives have not received adequate follow up. CODESRIA's Gender Institute of 2003 was therefore a step in the right direction towards filling this gap. The chapters in this book, which are the outcome of that institute, are a welcome contribution.

The findings of the UNESCO-funded project showed that gender inequalities in sciences are not inevitable. In fact, where public authorities, teacher associations and officials decided to take action, positive results regarding girls' involvement were obtained, such as in 'science clinics' in Ghana and Nigeria, Olympiads and *blocs scientifiques et technologiques* in Senegal. The present collection sheds light on situations on the continent and factors that hinder such positive actions.

A common theme runs through the chapters: the exclusion of girls and women from science and technology in Africa is about feminine identities, ideologies of domesticity and gender stereotypes. There are no clear policies on gender and science in most countries. Education practices follow societal beliefs and help define feminine

identities, which then reproduce the ideology of domesticity among girls and encourage a rejection of science and technology. Later in life, these ideologies translate into stereotypes that result in women being kept away from scientific positions and being denied access to technical jobs.

Issues of gender and science and technology are not witnessed in African countries alone. Few countries in the world have managed as yet to deal with these issues adequately. However, when Africa is involved, as is the case with everything else, these issues become enormous. A critical examination of feminist studies shows the voice of the African woman sadly lacking not only in science and technology but in everything else. Most feminist studies have been blind to the contradictions and complexities that inform girls' experiences. The task therefore is to reclaim the African woman from, not only exclusion from sciences, but also religion and other social areas. Exclusion is even affirmed in African mythology, where proverbs and all wise sayings stress gender differences and divisions.

Some Pertinent Questions about Science and Technology

What are science and technology? Science is concerned with how and why things happen, while technology deals with making things happen. Science explains the reasons behind phenomena, while technology is the use of tools, machines, materials, techniques and sources of power to make work easier and more productive. However, dominant science, as it is practiced today, adheres to Northern and Western conceptualisations, values and language use. As such, science is historically and culturally (read Western) located. It is not value-free.

Science should be informed—must be informed—by the daily experiences of people in the world. Yet, in most parts of Africa, the experiences of girls and women are excluded. This collection examines this exclusion and generally points at education policies and practices and cultural perceptions as the main hindrances to girls and women's participation in science and technology. However, there are many questions that still need answers: how do Third World scientists position themselves in the face of Western dominant science? How do African scientists interpret scientific meanings and technologies practised by their people? Are there other ways of 'knowing' (real African ways of knowing) that are lacking in science as it is taught today? Why African women? What distinctive approaches do women bring to science?

There are arguments that the knowledge of an African woman comes from her interaction with nature through, for example, subsistence agriculture and seed germination, as exemplified by initiatives such as the Green Belt movement in Kenya championed by Professor Wangari Maathai (Nobel Peace Laureate 2004). However, this knowledge is not documented, and neither are women's contributions incorporated into development initiatives. The writers of this volume, mainly drawn from the social sciences because of these subjects' strength in gender studies, make their contribution by showing how exclusion takes place and how much still remains to be done to overcome this exclusion. Questions related to science knowledge—and

whether there is a body of knowledge which can be called African science and technology—await elucidation, together with those posed above.

The chapters are grouped into three parts. Part I, 'Science and Technology in Society: Discourse, Perspectives, Practices and Policy', consists of three chapters. The first chapter, by Catherine Kitetu, is a kind of ground-clearing text for the other chapters. It starts by assessing the importance and place of science and technology today as key for socio-economic development in the world. It goes on to show the packaging and discourse of science that leads to the exclusion of Africans generally, and African women in particular. The discourse of science, that is, the language use, beliefs and ways of structuring knowledge that are upheld in society and in institutions where science is taught, are critiqued. The process of how discourse of science in schools, the institution through which science is perpetuated, positions women and girls to reduce their access to science and technology, is also outlined. Using an example from Kenya, it is shown how the wider society forms the base of much of these school-gendered practices. Other issues, such as foreign knowledge, worldview and languages used to transmit science for both African males and females, plus the mode of application of science and technology research in Africa, are raised for further debate. The chapter specifically calls for more qualitative analyses in Africa.

The second chapter, by John Forje, is on 'National Science Policy'. It is mainly a position paper that focuses on ways in which science and technology policies on the one hand, and research and development policies on the other, can be articulated and aggregated. Forje addresses these notions from a platform of thought provoking questions, many of which should goad scholars into lively debate. He acknowledges that little has been done to incorporate either science and technology or research and development into national development plans, and argues that African governments must stimulate and sponsor the promotion of science and technology through a comprehensive and concerted science and technology policy under the auspices of a national development strategy. Africa faces problems of pressing food shortages, illiteracy, energy insecurity, water supply, health care, shelter, communication and environmental problems, but it can contribute to the global scene by integrating science as we know it today with Africa's own inherent cultural heritage and indigenous knowledge systems.

Damian Opata, in his chapter on 'Binary Synthesis, Epistemic Naturalism, and Subjectivities', examines what he calls unwarranted antinomies, binary oppositions and adversarial knowledge politics that he sees as bedeviling gender scholarship in the West and which is being transported to Africa. He brings in the perspective of 'binary synthesis' (or complementary dualities) that, among the Igbo of Southeastern Nigeria, depicts an ontological order based on the mutual co-existence of things that are as they are. He argues that this perspective is necessary for gender studies in Africa and draws inspiration from the Igbo ontological nature of existence in which nature is seen as a model for technological development, and in which ordered subjectivities are framed on the notions of autonomy and individuation rather than

on gender. Opata's ideas invite debate. For example, one could consider the fact that, while Igbo culture recognises duality and male and female have each their spaces, yet the female cannot 'fly' as she wishes due to cultural constraints, many of which are not for her good.

Part II deals with science and technology in educational contexts. Science and technology are transmitted through education, and the exclusion of women from the sciences starts in the early phases of their education and through the kind of motivation they receive. This section starts with a chapter by Elisabeth Sherif in which she identifies the political and institutional causes of under-representation of girls. She analyses the actions and strategies adopted by the government of Niger in its regulation of the education system. Like many other African governments, it has been highly dependent on external financing in recent years. Sherif analyses, not only the government's political choices, but also its relations with international actors, such as the World Bank, in the context of the application of structural adjustment plans. The thrust of her argument is that, despite their apparent gender neutrality, educational policies have an impact on girls' access to scientific and technical education. She reiterates that the under-representation of women in science courses and programmes is an obstacle to development because it guarantees the reproduction of the cycle of gender-linked inequality and helps maintain women in a situation of socio-economic dependence. Sherif poses a question at the end, which should carry the debate on gender, science and technology further: Would the disastrous side of science have developed if women had participated in the design and implementation of science and technical projects?

The next chapter, by Ghislaine Agouhessou Yaya, is a critical analysis of how different policies for the education of girls in Benin have been carried out. She shows the socio-anthropological factors that determine and influence the selection of scientific subjects at school and university, and argues that Benin's education policies have helped steer female students away from scientific subjects at secondary and university levels. Yaya identifies the family, teachers and the labour market as key determinants of subject choice among students. As a way forward, she proposes re-training teachers, sensitising parents and re-examining the procedures of the council charged with placements of students.

Olubukola Olakunbi Ojo then shows how school counselors in Nigeria can and should be engaged productively in streamlining students into science and arts classes as part of the placement service that they provide in school settings. Ojo sees the role of counselors as indispensable in relation to girls' decision to enter science-related programmes. Counselors influence girls' perceptions of science and technology consciously, subconsciously and unconsciously. Guidance and counseling should be an indispensable arm of education, but sadly, in the survey she carried out, few counselors saw the need of encouraging girls to aim at science careers.

Kenneth Nyangena's chapter examines the views, on science and technology, of students in a high school in Kenya. He shows students' own role in the persistent

under-representation of the female population in education generally, and science specifically. He speculates that, if school science were made more 'girl-friendly', that is, centred on girls' interests and ways of working, this would be one step towards creating a feminine science. And if considerable numbers of girls (and boys) emerged from school, having learned science in this way, perhaps science as an institution would begin to change.

Mweru Mwingi's case study of girls' participation in science and technology education in Murang'a district in Kenya is a further examination of science in school. Her argument is that, while there are numerous studies that link negative attitudes to low female participation and poor achievement in science and technology subjects, few studies examine how accessible school subjects are within the school curriculum. For example, subjects in the secondary school curriculum in Kenya are said to be equally accessible to all; but in practice, access to science and technology subjects depends on the kind of school one attends. School curriculum implementation guidelines and socio-structural factors permeate subject choice.

Lydia Ayako Mareri looks at the handling of science in schools' extra-curricular activities. Recommendations have been made in policy documents in Kenya to enable curriculum materials to be re-designed to ensure that they are relevant to girls and boys and that teachers are sensitised to treat girls and boys equally. However, Mareri argues, this would not be possible without packaging this also in the extra-curricular programme. Focusing on out-of-class activities within the school setting, she discusses the roles that girls and boys are assigned in the performing arts (plays, dramatised dance, dramatised verse and oral narratives). She uses the performing arts items usually presented during the annual Kenya National Drama Festivals and finds that schools' out-of-class socialisation activities exclude girls from performances which contain science notions.

Does theatre matter? Does participation of girls and boys in specific roles matter? The question is whether girls can be influenced to do science through such activities. While the jury is still out, it can be argued that extra-curricular activities can provide opportunities for both girls and boys to familiarise themselves with science notions. More importantly, theatre can help to change the masculine image of science and also the stereotyping of girls as being unsuited for science careers.

Fibian Kavulani Lukalo provides another discussion on curriculum subject choices. In her chapter, she shows how the need for increased science and technology in Kenya led to the introduction of computer learning in schools in 1994, but how the categorisation of computer as a science subject led to poor participation by girls. Computer studies were mapped against the societal backdrop of gender biases which, when put together with geographical disparities in school type, availability of resources and infrastructure (electricity, water, laboratories, land and space) and teaching personnel, led to many problems from the start. It came as no surprise that only two girls were registered for the first national examinations in computer studies in secondary schools in 1998! Kavulani concludes that educational policy, with respect

to computer studies, reflects gender disparities and gender role expectations in the wider society, which adversely affects the participation of women and girls.

Part III: 'Science and Technology: The Case of One Woman, Many Women', adopts a historical perspective. This section shows that, while it is true that women have been excluded from science and technology, and their accumulated experiences and knowledge made invisible in the human scientific patrimony, yet women have never ceased devising clever and ingenious ways to enable them to master nature, though most of the time away from the limelight. The chapters in this section give us a glimpse of this history. Moriasi examines the life of Sudan's first woman surgeon. She showcases this woman as a rare role model for African girls and argues that oral history can be a basic tool in our efforts to incorporate the previously overlooked lives, activities and feelings of women. When women speak for themselves, they reveal hidden realities. New experiences and new perspectives emerge that challenge the 'truths' of official accounts and cast doubt upon established theories. Interviews with women can explore private realms such as reproduction, child rearing and sexuality to tell us what women actually did, can do or should have done. This chapter urges oral historians to develop techniques that will encourage women to say the unsaid. It is from this perspective that she traces the life and times of Nahid Toubia who, as the first woman surgeon in Sudan, conquered great odds to become what she is today.

Samson Omwoyo then assesses the impact of coffee production on Abagusii women of Western Kenya. His chapter blends two important themes: the changing role of women in agricultural production and the impact of new agricultural technologies. Women were disadvantaged in the pre-colonial period, and the oppressive and exploitative relationship between men and women in pre-colonial Gusiiland was amplified by technological innovations accompanying the introduction of coffee in the area. The lucrative cash crop was often the preserve of male farmers, while female farmers were relegated to subsistence crop production. Research into high-yielding varieties and the use of pesticides and fertilisers benefited male farmers, thus entrenching them in 'modern' agriculture, with female labour. Omwoyo analyses the response of women in coping with this marginalisation and their methods of survival.

The last chapter in Part III, by Anthonia Achike, looks at gender-based associations (GBAs) and their role in enhancing the participation of female farmers in science and technology projects in Anambra State, Nigeria. Drawing her data from a survey study of five GBAs, she shows how they have responded to the plight of disadvantaged female farmers by having more female-targeted science and technology innovations in their portfolios. Unfortunately, however, female GBAs attract less external financial assistance from governments and international organisations when compared to their male counterparts. Hence, female GBAs have less technical and financial potential to assist female farmers despite their stronger grassroots support.

This is in line with the age-old thinking where, almost by instinct, women are considered to be less capable of creating science and technology.

The research presented in this book is characterised by the researchers' own chosen topics based on their geographical areas of operation. Although studies from the Northern and the Horn of Africa are missing (there were no participants), the chapters provide a window, albeit a limited one, onto the current state of female participation in science and technology in Africa, along with analysis of the historical backgrounds and discussion of what needs to be done in the future. Clearly, more research urgently needs to be done with more groups throughout Africa. It is our hope that these studies will inspire more qualitative work within the continent in relation to gender science and technology.

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