Policy Brief

Capacity-Building of Mathematics and Science Teachers in Africa: Innovative Home-Grown Approaches to Funding

Executive Summary

Africa’s great need for innovative funding models for sustainable capacity-building programmes for mathematics and science teachers

Recent international frameworks adopted by African Heads of States affirm the important role of mathematics and science in education in Africa’s development. However, due to lack of properly trained and motivated teachers, the continent still faces a daunting task in attracting enough students to enrol in these subjects and in ensuring quality. In order to address this challenge, some 27 Sub-Saharan African countries have come together to collaborate on capacity-building of mathematics and science teachers for effective classroom practices. With support from the Governments of Japan and Kenya, a continental training centre has been established and a pool of over 1,650 trainers of trainers has been developed.

In spite of this noble effort, the majority of the 27 countries continue to face challenges in establishing sustainable funding for the programmes due to limited resources and ballooning education budgets. However, all is not lost as demonstrated by some of the countries, particularly Kenya. The country has over the years developed a sustainable funding model where budgets for capacity-building of mathematics and science teachers are mainstreamed into existing school funding programmes. This policy paper therefore recommends the adaptation of such successful models. Alternatively, funds can be levied from organizations and sectors that directly benefit from mathematics and science education through public private partnerships.

Context and Justification for Action

Mathematics and Science Education in Africa

Science, technology and innovation have increasingly become the main drivers of the global economy as opposed to traditional players such as capital, labour and land. Africa recognises this important shift. Heads of States and Governments adopted the “Addis Ababa Declaration on Science and Technology and Scientific Research for Development” in January 2007. This was an acknowledgement of the importance of science, technology and innovation in the provision of basic services such as good health care, clean water, improved sanitation and adequate infrastructure among others. However, science, technology and innovation cannot be effectively harnessed for growth and development without a sufficiently educated and trained workforce that can acquire, adopt, disseminate and utilise knowledge and also transform or convert knowledge into growth and development outputs. Such skills and abilities depend to a large extent on basic mathematical and scientific skills. According to The World Bank, science and mathematics are essential for building modern knowledge and skills. It also cultivates ability to take initiatives, solve problems and innovate products and processes. These are the elements that regional integration and labour market mobility are increasingly demanding.

Mathematics and Science Education in National Development

Affirming this, the United Nations Rio 20+ Declaration “The Future We Want”, recognised mathematics and science education as pillars for economic growth and national development. In spite of this, Africa faces a number of challenges in its effort to provide quality mathematics and science education. The UNESCO Science Report 2010 notes Africa’s comparative disadvantage with regard to overall development. This is attributed to low investment in science, technology and innovation and the adoption of a short-term view of human development. The Science Technology and Innovation Forum held in Kenya in 2012 reported that the demand for science, technology and mathematics is growing exponentially but enrolments in the area are not keeping pace. On the contrary, enrolments in these subjects are generally declining. The Global Monitoring Report of 2013/14 further highlights Africa’s plight in pointing out that levels of learning achievements in several Sub-Saharan Africa countries are still desperately low. The mid-term review of the 2nd Decade Plan of Action (2006-2015) also identifies lack of science and mathematics knowledge as one of the outstanding challenges Africa needs to solve. It reports that Africa has the lowest enrolment and graduation rates in science and mathematics.
The challenges facing mathematics and science education in Africa can be traced back to several root causes, the most significant being the educators themselves. The role of quality teachers in ensuring attainment of learning outcomes cannot be overemphasised. However, 50 per cent of serving teachers in Sub-Saharan Africa are either unqualified or under-qualified. The supply of science, mathematics and technology teachers is on the average only half of the demand at secondary and higher education levels. If Africa is to develop, then urgent measures to ensure sustainable supply of quality of mathematics and science teachers must be put in place.

Individual country reports reveal that mathematics and science at the basic education level face similar challenges. Several African countries have therefore come together to create synergy in improving the quality of teaching and learning mathematics in these subjects. In 2001, these countries created a network through which educators could interrogate pertinent issues, and develop and share best practices in the teaching and learning of these subjects. Bringing together 27 countries and operating under the auspices of Strengthening of Mathematics and Science Education in Africa (SMASE-Africa) and the ADEA Inter-Country Quality Node on Mathematics and Science Education (ICQN-MSE), the network has initiated continental and country-based capacity-building programmes. The main aim of these programmes is to improve learning outcomes by enhancing teacher classroom practices and cultivating positive attitudes through making mathematics and science more accessible.

The capacity-building programmes are implemented at the Centre for Mathematics, Science and Technology Education (CEMASTEA). The Centre prepares trainers of trainers which individual countries can use for country-based programmes. Since 2004, CEMASTEA has prepared 1,683 of these trainers. These now form a body of experts, not only for their own countries but for the whole continent. Fifteen of these countries have initiated in-country development programmes. Evaluation studies of the programmes have indicated high levels of effectiveness. In a 2013 survey, 97 per cent of the course participants reported that the programme had enhanced their capacities. Impact assessment studies conducted in 2008, 2012, and 2013 also revealed that the programme a has statistically significant effect on students’ achievement test scores when taught by teachers trained through the programme.

Initiatives to Address Challenges

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Impact of the Initiatives

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A Critique Of Policy Options

Overview of funding policy options

Currently 27 out of 55 African countries participate in the capacity-building programmes at CEMASTEA. However, only 15 use the trainers of educators to implement country-based programmes. A large portion of the continent is yet to be reached. A major factor which impedes growth in this area is the lack of sustainable funding models that can be used to mainstream the capacity-building activities into national programmes. The most common approach to funding is through programmes is within the framework of bilateral technical cooperation projects with specific lifespans. The development partner(s), mainly Japan International Cooperation Agency JICA), provide start-up training materials, equipment, and capacity-building for a skeleton staff. The collaborating governments provide staff, infrastructure and counterpart funding for meals, accommodation and transportation costs of participating teachers.

Limitations of Current Policy

The programmes are therefore not financially sustainable except where participating African governments take deliberate measures to mitigate the situation. When the bilateral agreements lapse, two scenarios often unfold. The concerned government continues with the capacity-building activities as a national programme or the budget allocation is discontinued and the whole activity becomes a ‘white-elephant’. The last scenario is more often the case. Much of the efforts are lost and the investments wasted. For countries that continue with the programmes, it is not uncommon to find that when more pressing priorities emerge, the budgets for the capacity-building programmes are diverted there. However, some positive outcomes have emerged. A number of countries have come up with innovative approaches to ensure sustainable funding for the programmes. A case in point is the Kenya’s Strengthening Mathematics and Science (SMASE) Programme.

Sustainable Funding: Lessons From Kenya’s Model

At the onset, the design of the Kenya’s SMASE Programme intentionally inbuilt a sustainable funding mechanism based on the fact that schools will always receive funding; either from parents or governments under the free education programmes. The SMASE programme therefore lobbied key stakeholders for infrastructure and the purchase of large machinery and equipment. Stakeholders agreed that it was also very important to use the funds to ‘develop the teacher’. Local education boards therefore authorised schools to remit to the District Education Office between 2.5-7.5 per cent of the development fund to support teacher capacity-building. As it was part of an existing levy, there was no increase in school fees and hence the teacher capacity-building programmes did not increase any financial burden on parents. When the government introduced the Free Secondary Education (FSE) Programme in 2008 the ministry responsible for education mainstreamed the capacity-building funds into this area. Consequently, each per-capita allocation includes
some US$2.30 reserved for the teacher capacity-building programme. The important element in this funding arrangement is that, where there is no FSE, parents will always pay school fees and where there is FSE, money will always be remitted to schools and the capacity-building programmes are thus always assured of funding. This is unlike the case where a specific budget is allocated to the programme and can be diverted or withdrawn if circumstances dictate.

**Conclusion**

*In spite of resource constraints, there are innovative home-grown solutions such as the Kenyan model*

Teachers are at the heart of quality mathematics and science education and are essential as a foundation for the effective application of science, technology and innovation. Ensuring a sustainable supply of properly trained and motivated teachers is therefore critical. In the last decade, African Governments and Development Partners have invested enormous resources in preparing a large body of mathematics and science trainers of educators for the continent. Nevertheless, many countries are still unable to utilise this human resource-base to mount in-country programmes in order to enhance mathematics and science education. These countries are faced with ballooning education budgets making allocation of additional resources to cater for these critical issues a challenge. This model mainstreams such budgets into existing school funding programmes without seeking additional resources.

**Policy Implications and Recommendations**

**Policy Implications**

If no innovative home-grown models for mainstreaming sustainable teacher capacity-building programmes into the existing resource base are developed, it will be difficult to ensure the required supply of well-trained and motivated Mathematics and Science teachers. Additionally, the body of previously trained educators will also remain under-utilised and the resources that have been spent will have gone to waste.
In view of this extensive research and information, it is recommended that African Governments:

1) adopt or adapt home-grown solutions such as the Kenyan model of funding teacher capacity development;
2) introduce levies for funding teacher capacity development to be paid by relevant organizations such as telecommunication companies, manufacturing industries and insurance companies that benefit from educated mathematics and science population;
3) promote public and private partnership arrangements for funding teacher capacity development;
4) use the pool of previously trained educators to spread effective mathematics and science classroom practices across the continent.

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