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Association for the
Development of
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POLICY BRIEF N° 1

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Development of Country Policy on Provision of Quality STEM Education at the Basic Learning Levels in Africa

1 INTRODUCTION

Africa is faced with many challenges including a rapidly increasing population, currently estimated at 1.2 billion people. Additionally, one in every five persons in Africa are youth aged 15-24 years, who are largely unemployed. Every year, 11 million youth in Africa join the labour market, and many of them are not prepared for the skills demand of the existing jobs. Meanwhile, the COVID-19 pandemic has amplified economic challenges in Africa, and this will continue to be felt for many years to come.

A strategic response to these challenges is to accelerate investment in quality STEM education at the basic learning levels to equip the youth with relevant STEM skills to take up emerging opportunities in the STEM careers in Africa.

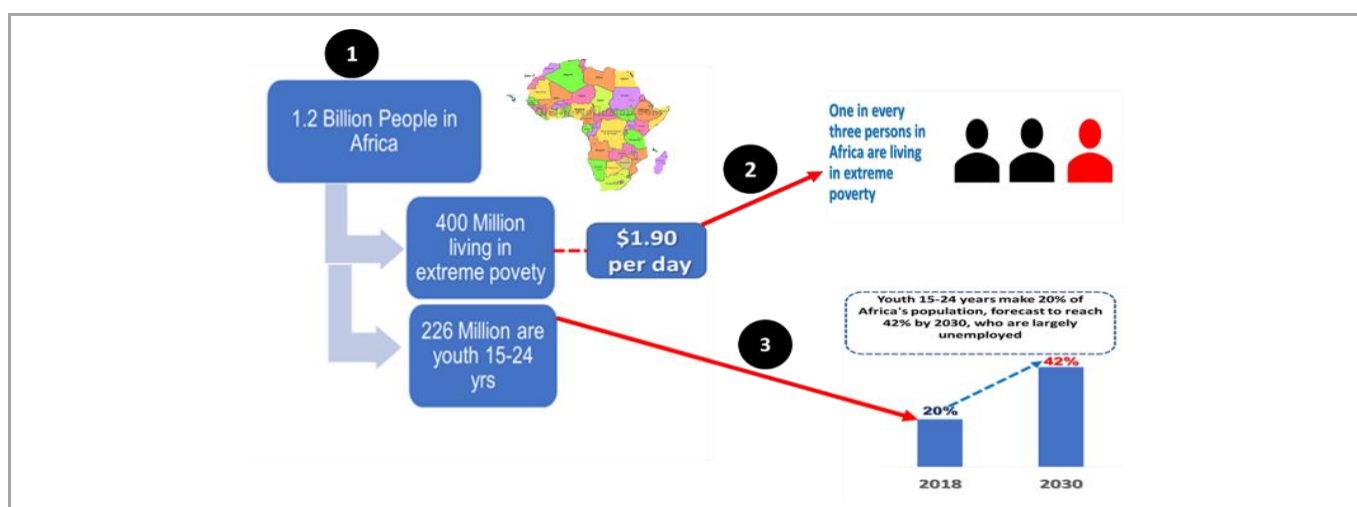
However, the weak link is lack of a comprehensive policy framework on provision of quality STEM education at the basic learning levels in Africa that would guide in the sustainable provision of quality STEM education.

Therefore, the national education authorities in Africa should prioritise development and implementation of a **comprehensive policy framework for the provision of quality STEM education at the basic learning levels**. This policy should inform integrated and multi-dimensional approaches for resource mobilisation, interventions, partnerships, coordination, and quality assurance in the delivery of quality STEM education at the basic education learning levels.

Africa is faced with myriad challenges including adverse impact of climate change, manifested in frequent droughts, biodiversity and ecosystem loss, desertification, and food insecurity (Serdeczny, Adams, Baarsch, & et al, 2017). Furthermore, the population in Africa is rapidly increasing, currently estimated at 1.2 billion people, and among them are 400 million or one in every three persons living in extreme poverty (UN Economic Commission for Africa, 2012). One in every five persons or 20% of the population in Africa are youth aged 15-24 years, who are largely unemployed and are forecasted

to reach 42% of the population or two in every five persons by 2030 (The World Bank, 2020). Every year, 11 million youth in Africa are joining the labour market and many are not prepared for the demands of the existing jobs (International Labour Organization, 2020). Meanwhile, the COVID-19 pandemic will lead to the contraction of the Real GDP in Africa by 3.4 percent, down 7.3 percentage points from the growth projected before the outbreak of COVID-19 with dire economic consequences in the years to come (African Development Bank, 2020).

Figure 1: Key demographic trends in Africa.

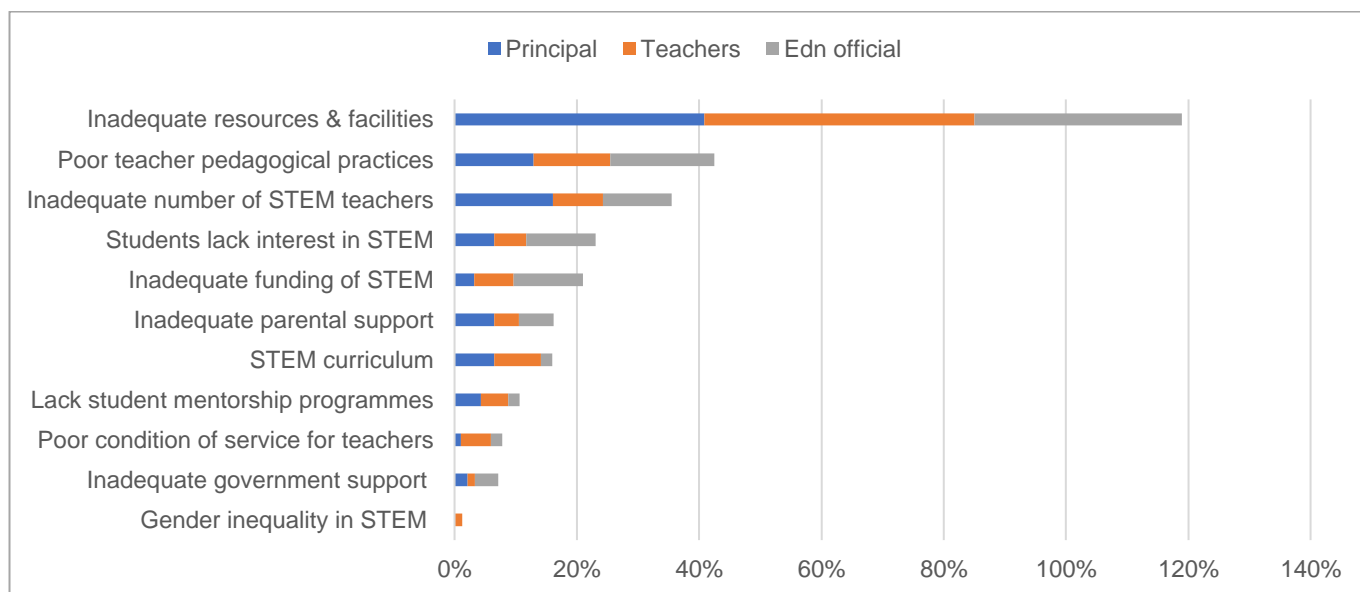


A strategic response to these challenges is to take decisive actions and accelerate investment for improving the quality of STEM education at the basic learning levels and equip the youth with relevant STEM skills to take up emerging opportunities in the STEM careers in Africa (Formunyam, 2020). STEM education creates critical thinkers, increases scientific literacy, and enables the next generation of innovators (Engineering for Kids, 2020). STEM skills are important because they pervade every part of our lives and by giving students opportunities to explore STEM-related concepts, they will develop a passion for it and increase their potential to pursue STEM related courses and careers. However, while most jobs of the future will require STEM skills, there lacks an adequate understanding of the status of STEM education, and level of preparedness for implementation of comprehensive STEM education programmes in Africa (Matachi & Kosaka, 2017; The Planet Earth Institute, 2016).

The ADEA-initiated situational analysis on the status of STEM education at the basic learning levels in Africa found that poor performance in STEM education at the basic learning level in Africa was noted from the 1980s (Oluka, 2017). This situation has persisted, without any notable changes and this is a significant barrier to improved economic and social outcomes in Africa (Oluka, 2017; Bethell, 2016).

The situational analysis reveals underlying systemic challenges that have led to low investment in STEM education. Where attempts have been made to invest in STEM education, the interventions are fragmented, unsustainable, and are not backed with a comprehensive policy framework. The key challenges include inadequate teaching and learning resources and facilities for STEM, poor teacher pedagogical practices, student lack of interest in STEM subjects, lack of student mentorship programmes, and insufficient number of teachers of STEM subjects (**Figure 2**).

Figure 2: Challenges in achieving quality STEM education.



The foregoing challenges have implication on student access and participation in STEM courses at institution of higher education, STEM careers, youth employment, and economic prosperity in Africa. At the very basic level, countries in African should develop a comprehensive policy on provision of quality STEM education as a strategic shift towards

deliberate and accelerated investment in STEM education. Massification of STEM education is seen as one of the strategies to enable Africa to prepare for the future as it is estimated that over the next decades there will be thousands of job openings in Africa that will require basic STEM literacy (Formunyam, 2020; Ahmed, 2016).

3 CURRENT APPROACHES

At the continental level, the African Union (AU) recognizes that STEM education at the secondary school education cycle is critical for the development of a well-equipped human capital capable of competing in increasingly science and technology-driven and knowledge-based global economies (African Union, 2015). The AU also acknowledges the inability of the workforce in Africa to fill the existing STEM jobs due to lack of requisite STEM skills, the relevance of the current secondary school education in terms employability, technical and vocational training, and progression to tertiary education.

There are several on-going interventions¹ for improvement of quality of STEM education in

Africa that are being implemented through donor funded projects, government initiatives and NGOs. The key characteristic of these interventions are; a) some are national in scope, while others are localized in specific sub-geographies within a country, while still others are cross-country interventions²; b) government and development partners are joint sponsors for most of the interventions; however, there are many interventions that are initiated by private entities and individual philanthropists which are largely localized in scope; c) the government interventions are embedded within national education sector plans.

¹ a) Outreach programme of the Botswana International University of Science and Technology by Botswana International University of Science and Technology (BIUST); b) Strengthening the quality of mathematics and science education at basic education level in Kenya by Centre for Mathematics, Science, and Technology Education in Africa (CEMASTEA) supported by Government of Kenya and JICA; c) Pan-African Research and Materials Development Centre for The Promotion of Community Science and Technology in African Schools by the Centre for School and Community Science and Technology Studies (SACOST)

sponsored by the University of Education at Winneba, Ghana; d) The Secondary Science and Mathematics (SESEMAT) programme by the Ministry of Education and Sports (MoES) Sponsored Japan International Cooperation Agency (JICA) and Republic of Uganda.

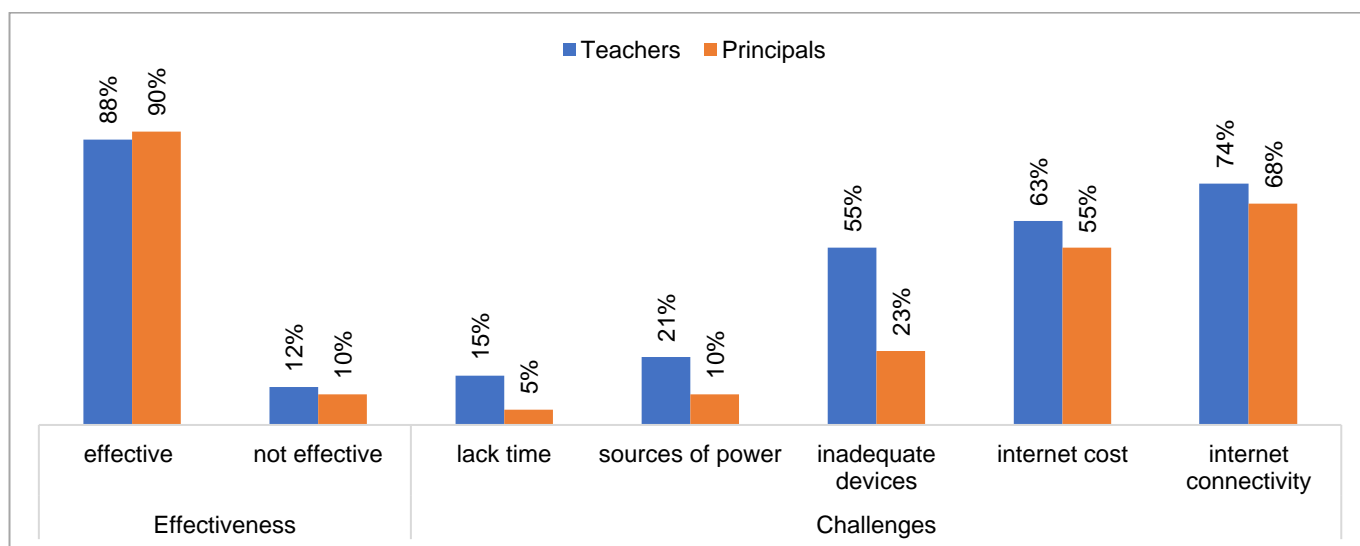
² Strengthening of Mathematics, Science, and Technology Education in Africa (SMASE Africa).

The ADEA-initiated situational analysis reviewed a sample of interventions and these were found to be mainly focused on; a) teacher professional development; b) provision of teaching and learning resources and facilities; c) student mentorships on STEM education; d) scientific and technology fairs. However, most of these interventions have not documented results, and it was uncertain about their reach and impact. Aside from the government and some donor funded initiatives, the education authorities lacked a comprehensive database of on-going interventions for improvement of quality of STEM education at the basic learning levels. Therefore, it is instructive that countries in Africa should embark on a mapping exercise to establish the full range, scope, and scale of past and current interventions as a strategy for drawing

comprehensive lessons and best practices in improving the quality of STEM education at the basic learning level. Without a comprehensive inventory, the interventions will remain fragmented and are not likely to generate valuable lessons on strategies for improvement of the quality of STEM education at the basic learning levels.

A high proportion of STEM teachers were participating in the interventions including through online technologies, which is now more relevant considering the COVID-19 pandemic (**Figure 3**). However, specific to participation through online technologies, some of the key challenges they face are lack of devices, and internet connectivity.

Figure 3: Effectiveness and challenges of online STEM forums.



While it is widely acknowledged that STEM skills are fundamental for supporting technological innovations, creating jobs, and employment opportunities in STEM careers with higher earnings, African countries, unlike those in the global north, are in the nascent stages of investing in this critical sector. Furthermore, there are multi-dimensional challenges derailing improvement in quality of STEM education in Africa, which require adoption of integrated and multi-faceted approaches and partnerships with all key stakeholders in the STEM education agenda.

Ultimately, African countries can confront the challenges facing STEM education and create a critical mass of youth with relevant STEM skills for individual development and economic prosperity of the African countries. Efforts should focus on increasing student access and participation in opportunities in STEM education, courses, and careers. However, the weak link is the lack of a comprehensive policy framework on provision of quality STEM education at the basic learning levels.

The education authorities in Africa should develop and implement a **comprehensive policy framework for the provision of quality STEM education at the basic learning levels**. This policy will lay the ground for structured engagement in the whole spectrum of delivery of quality STEM education, by informing strategies, mechanisms, resource mobilisation and funding models, partnerships, coordination, and quality assurance in the delivery of quality of STEM education at the basic education learning levels. The policy should articulate expected results, measurement, and coordination across multiple levels. The policy framework should adopt integrated and multi-dimensional approaches articulating the following key areas that have emerged as challenges in achieving quality STEM education at the basic learning levels in Africa:

4.1. Mapping of interventions in STEM education:

provision for a system of mapping STEM interventions in terms of: scale of operations, key strategies, timelines, reach, and impact, and funders, and establishment of a comprehensive database and identification of emerging innovations and best practices.

4.2. Resource mobilisation to fund STEM education:

enhance partnership between education authorities and development partners to adequately fund initiatives for improvement of STEM at the basic learning levels. This will ensure provision of resources and facilities including classrooms, laboratories, laboratory equipment and chemicals, computers, textbooks, and internet connectivity are critical for delivery of quality STEM education, and they were frequently mentioned as insufficient. It should on investment in integration of ICT in pedagogy for delivery of STEM curriculum for quality improvement and the apparent reality of curriculum delivery through online technologies in the advent of COVID19 pandemic.

4.3. STEM training programmes for educators:

the policy should address provision for sustainable models of regular capacity building of teachers of STEM building upon existing models in some of the countries including Kenya, Uganda, Zambia, and Nigeria.

The policy should also focus on provision of capacity building for school leadership for sustainability of STEM initiatives. This should include capacity building development of school STEM strategies for deliberate and sustainable strategies in improving quality of STEM education. The policy should nurture communities of practice on different aspects of STEM education at the basic learning levels, through technical working groups, and encouraging collaborations among educators of STEM education.

4.4. Student mentorship programmes on STEM:

provide for student mentorship programmes for higher uptake of STEM subjects, courses, and careers. This should also include promotion, participation, and exposure of student through science and technology fairs and excursions to spark their interest and develop a passion for STEM subjects. The student mentorship programmes should include sensitisation of parents on STEM as they are important influencers of careers choices of their children

4.5. Strategies on management of COVID-19 and other pandemics:

for sustainable management of COVID-19 in the education sector, develop comprehensive strategies for implementation of health guidelines and protocols.

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