ADEA 2017
Triennale

Education and Training in Africa

CONCEPT NOTE ON **SUB-THEME 2**

Promoting Science, Mathematics and ICT

Abdou Diouf International Conference Center (CICAD)
14th - 17th March 2017 – Diamniadio (Dakar), Senegal

Table of contents

1. Introduction

Sub-theme 2 is one of the four sub-themes of the ADEA 2017 Triennale whose theme is *"Revitalizing education towards the 2030 Global Agenda and Africa's Agenda 2063"*. The Triennale scheduled to be held in Senegal in 2017 will provide a platform for policy dialogue, sharing knowledge and experiences that have promising effects of transforming Africa's education systems for sustainable development. As part of the preparatory process leading to the Triennale, ICQN-MSE will, in close consultation with ADEA Secretariat coordinate other ICQNs and Working Groups that work and support areas related to sub-theme 2. The coordination process will involve developing the sub-theme's input to the Triennale through consultations with relevant ICQNs and Working Groups and selected countries. This will lead to products such as research papers, case studies and projects in a variety of forms such as audio, video and live presentations to guide discussions under sub-theme 2 during the Triennial.

2. Background, rationale and objectives

The global community adopted the Sustainable Development Goals (SDGs) in September 2015 with Goal no.4 focusing on ensuring quality education and opportunities for lifelong education for all. The African Union also adopted Agenda 2063 which calls for a "revolution of education, skills and active promotion of science, technology, research and innovation in order to strengthen knowledge, human resources, capacities and peoples' abilities for the African century".

According to the American Association of Sciences (2015), Science, Mathematics, and Technology are at the centre of the rapid changes taking place globally and transforming how the human race lives and works. Citizens therefore need specific science, mathematics and technology competencies to understand and engage in critical discussion about these issues. Africa therefore requires a cadre of well educated scientists to undertake research and scientific and technological innovations that are essential to meet its economic, social and environmental challenges.

Use of ICT is emerging as an important instructional method in science and mathematics across the continent. There is increasing evidence of a correlation between countries investing in ICT to enhance education performance in the core subjects of mathematics, science and reading and high scoring in international achievement tests such as OECD PISA (OECD, 2009). Similarly, Thioune (2003) reports that for the past two decades most developed countries have witnessed significant changes in almost all aspects of life: economics, education, communication, and travel that can be traced to ICTs.

This concept note is intended to provide a framework and implementation roadmap to guide the preparatory process for realising the objectives of sub-theme 2. The note aims at:

a)   defining a shared working framework for all entities contributing to the preparatory work on Sub-Theme 2

b)   providing methodological guidelines to drive preparatory work on the sub-theme, distributes tasks among various stakeholders and contributors and proposes an agenda and a calendar.

The concept note will also serve as scientific management tool, for the coordination of the whole work on the sub-theme, quality control and preparation of the thematic summary

3. Main issues

Evidence suggests that Africa is not making the most of science, mathematics and ICT to provide its youth with the skills that will put them in a strong position to improve their lives and the societies they live in. Akyeampong (2016) enumerates the myriad gaps in Africa's mathematics and science education while Africa Economic Outlook (2014) argues that many young Africans even if they are lucky enough to complete secondary education are either unemployed or unemployable due to a lack of basic mathematics and science skills. Similarly, the African Development Bank (2008) contends that Africa's science, technology and innovation education and training infrastructure has been under-valued and under-resourced which negatively impacted on the capacity of the continent to supply the needed skills base, especially in science and technology.

Several African countries have taken steps to make science, mathematics and ICT relevant to their development needs mostly through curriculum reforms but these ideas or innovations are not making a big impact because little attention has been paid how to improve how mathematics and science teachers learn and teach the subjects (Akyeampong, 2016). However, there could be pockets of success. Therefore, ICQN-MSE will explore major implementation issues, establish whether there are any innovative initiatives to address these challenges, and the possibility of replication and scale up. The issues in mathematics, science, and ICT are enumerated in the next sub-section.

3.1. Issues in mathematics and science

a)   Children are coming out of school without basic skills

According to Brookings Center for Universal Education (The Brookings Institute, 2016), 61 million African children reach adolescence lacking even the most basic literacy and numeracy skills. UNESCO (2012) notes that basic numeracy and literacy skills are the most elemental for getting decent work that can pay enough to meet daily needs. This failure to tackle the learning deficit will deprive a whole generation of opportunities to develop their potential and escape poverty (The Brookings Institute, 2016). Singled out as the major underlying factor is the pervasive scarcity of skilled teachers at all levels as well as class size prevents teachers from interacting with students, attending to those who need special attention, or practicing learner-centered techniques. This is compounded by the lack of learning materials and inadequate ECD programs. Though several countries have had initiatives aimed at addressing these challenge, their impacts have been low due implementation challenges.

b)   Exam Oriented Curriculum

Most African countries education systems are exam-oriented that do not encourage tangible application that demonstrate learner competence in using content, information, ideas and tools successfully to solve daily life problems. Selecting elites is the priority rather than ensuring learning success for all.

c)   Huge gap between women and men in exploring careers in STEM

In Sub-Saharan Africa, in upper secondary school, the best registered percentage for enrolment of girls in mathematics is about 30%, a percentage that decreases with grade level. By tertiary

level it is about 10% (International Mathematics Union, 2014) hence only a few of the female students joining University pursue STEM related courses (Masanja, Butare & Huye, 2010). Historical, religious and cultural factors have been identified as the key determinants girls' low participation in mathematics education of girls. ICQN-MSE will collaborate with FAWE and other relevant partners establish best practices in bridging the gender gap.

d) Scientific Literacy Benchmarks and Mathematics Standards for Africa

Most of the member states do not have science literacy benchmarks and mathematics standards. They therefore do not have a basis for developing science and mathematics curriculum and assessment and evaluation. ICQN-MSE will gather information on countries with science literacy benchmarks and mathematics standards and successfully implementing the same.

e) STEM Data Blanks

Although Southern African countries have the Southern African Consortium on Monitoring Education Quality (SACMEQ) and Francophone countries the PASEC, they do not serve the whole of Africa and also deals with primary level education only. It also occasionally it is not regular. Consequently there exist gaps in national and regional robust comparative data on learners' achievement in mathematics and science to guide on informed decision making. (Please see and consider the PASEC for Francophone countries: the last report provides interesting figures on learners' performances in mathematics at primary level)

f) Role of language of instruction in the teaching and learning of STEM subjects

Mathematics and science are replete with technical language. However, in most countries of Africa, the language of instruction is not the learner's first language, except in lower primary. Moreover, the language used in textbooks at all levels is generally not the learners' first language. The Learners therefore experience a double load of learning both the technical and instructional language which compromises the quality of understanding.

g) Lack of Support Mechanisms for Gifted Mathematics and Science Students

Africa has limited mechanisms for identifying, tracking and supporting gifted science and mathematics students. This is because most countries mainly use examinations for placement purposes. Such mechanisms, where available, might make a small but concrete contribution to the development of science and mathematics in African countries.

h) Brain Drain

Nearly half of Africans who study abroad do not return due to lack of unrewarding positions yet most of them are talented. This brain drain can be reduced by strengthening training opportunities within Africa.

3.2. Issues in information and communication technology

a) ICT Infrastructure

Due to inadequate financing and lack of prioritisation, Africa has inadequate physical infrastructure, especially the intra-African broad band terrestrial infrastructure. Only 30% of the population has access to electricity, compared to 70-90% in other parts of the developing world. Internet penetration in Africa is 16% compared to the average of 80% in developed countries. However, the continent has witnessed high penetration rates in mobile telephony (in some places 95%), but it is yet to trigger wide-scale application in teaching and learning.

b) Inadequate human capacity/skills

Many African countries lack adequate number of teachers that are skilled in ICT integration in teaching and learning yet ICT can be used to address an array of challenges in education. This is mainly due to inadequate infrastructure and capacity building programmes.

c) Access to ICT by learners with Special Needs

Discussions around ICT hardly incorporate issues involving learners with special needs. This raises the questions of not only how but also what ICT tools can be used to help such learners access ICT in education and life in general.

4. Methodological guidelines for the preparatory work

In the implementation of sub-theme 2, ICQN-MSE will be guided by several key principles. Firstly, focus will be on how to resolve implementation challenges that most African countries face in implementing frameworks, programmes and projects. African and or non-African experiences that have successfully addressed these challenges will be explored. Lessons learnt will be identified in order to create or recreate the successful conditions and factors to enable African countries to achieve the goals and educational targets of the 2030 Programme and the 2063 Agenda in the post-2015 era. If there are no successful experiences, reasons will be explored. In addition, it would be important to. Secondly, a holistic approach that takes into account all educational resources in formal, non-formal and informal settings at all levels; pre-school to higher education in teaching, training and learning in face to face or distance learning approaches at every age will be adopted. Thirdly, active contribution of all stakeholders of the African educational system will be sought to ensure the approach is as participatory as possible will be an critical component of the process to cultivate and nurture ownership of the programme outcomes. Lastly, ICQN-MSE will greatly rely on the expertise of other ADEA units (Working Groups, ICQNs, Task Force and their country networks and institutions and expert agencies). ICQN-MSE will select a network of countries (Nigeria, Zambia, Senegal, Kenya, Rwanda, Morocco) with which they will work together with pilot countries (Angola, Egypt, DRC/Gabon, Kenya, Senegal) which offer examples of good practices in the implementation of educational development policies and strategies regarding the sub-theme 2. Consequently, before the country consultations, ICQN-MSE will conduct desk reviews of the status of mathematics, science and ICT within the identified countries. The desk reviews will focus on the implementation challenges identified under section 2 of this note as well as successful or promising intervention with regard to learning outcomes, successful piloting and up-scaling, innovative funding approaches, etc. During the country consultations, the identified cases will be validated or other issues and interventions identified. After the consultations, an in-depth analysis of each of the validated cases will be conducted with a view to consolidating the meta-analysis or background papers. During the country

consultation forums, focus will also be on lessons learnt from the various experiences that will be presented.

5. Deliverables and the relevance and quality criteria

Arising from the methodological process, ICQN-MSE expects to present to the Triennale deliverables in the form of case studies/meta-analyses/background papers, documentaries on what works and testimonies of beneficiaries or those leading the process, and results of existing or ongoing programmes and projects; panel discussions on topical issues, These deliverables will be structured summaries of effective interventions and lessons learnt on issues and major challenges identified under section two of this methodological note and derived from a collection and analysis of targeted knowledge and experiences. For example, Kenya has had a targeted intervention at numeracy in early years with encouraging results. This initiative is now being up-scaled with support from Global Partnerships for Education.

In line with the Triennale principles, the deliverables will have to be focused on identifying implementation challenges African countries are facing and why they did not succeed in addressing them. The deliverable will not be complete without articulating African experiences and/or non-African experiences that have successfully addressed the identified challenges; how they succeeded and what lessons can be learnt from them in order to create or recreate the successful conditions and factors to enable African countries to achieve the goals and educational targets of the 2030 SDGs and the Agenda 2063 in the post -2015 era. For example, Nigeria has had a very successful experience with regard to stakeholder participation in the up-scaling of professional development programmes for its primary mathematics and science teachers. Similarly, Zambia appears to be doing well with regard to developing communities of practice among secondary mathematics and science teachers whereas Rwanda has had success with regard to ICT integration into teaching and learning at primary school level.

6. Organisation of work

6.1. Consultations in pilot countries

ICQN-MSE will work with pilot countries identified in section 3 to identify programmes that meet criteria in section 4 above. Focal points in the selected countries will be identified and virtual consultations held on how the countries can participate in the consultative meetings as well as regional consultative meetings. Virtual consultative meetings will be arranged with the support of JICA Kenya and African Development Bank offices in Nairobi. Country based consultative meetings will be followed by Regional consultative meeting. The country level consultative meetings will be spearheaded by the pilot countries with support from ICQN-MSE. Consultative meetings based on language groups that may also present unique challenges will also be conducted for Anglophone, Francophone, Lusophone, and Arabic countries. Inbuilt into these consultative processes will be ways through which the pilot countries can learn from their experiences.

6.2. Distribution of tasks

The ICQN-MSE will coordinate the preparatory work in sub-theme 2. It will determine the expected outcomes respectively (studies, films or other audio-visual materials, testimonies of stakeholders,

exhibitions, etc) and as a result organise the activities for the collection and analysis; monitor, receive, complement and evaluate the contributions received from the countries, other WGs and ICQNs, partner institutions with the view to analysing the thematic summaries relating to the framework of discussions and sharing of lessons during the Triennial.

The sub-theme 2 tasks will be carried out in collaboration with all institutions and organizations that are repositories of knowledge and experiences mathematics, science and ICT in Africa and elsewhere: governments, African or international organizations, bilateral cooperation agencies, institutes and research networks, the private sector, NGOs and civil society organizations. The ADEA Units will be expected to support ICQN-MSE in the implementation of sub-theme 2 tasks as follows:

Stakeholders	Nature of Task/Support
JICA	▪ Lead Partner of sub-theme 2 supporting the whole preparatory process and participation in the triennial besides; ▪ To consolidate learning around its many mathematics and science projects in Africa into an analytical paper/documentary/etc.
African Union Commission	To provide studies on sub-theme 2 that were conducted as part of the consultative process of the post 2015 agenda as well as Agenda 2063.
Governments of Pilot and participating Countries	Participate in the whole process by organising country-based consultative forums and participating in the regional consultative forums and sharing country-based experiences.
World Bank	Share with ICQN-MSE the work the bank is doing on STEM in Africa
UNESCO	As the global custodian of science, UNESCO will be requested to provide basic and current comparative statistics on science in Africa and as well as promising practices and approaches in Africa and elsewhere.
AIMS	▪ To share experiences of their work and financially support some activities; ▪ To provide studies it has done on STEM in Africa; ▪ To provide ongoing initiatives to strengthen STEM education in Africa.
GESCI	To share promising approaches and experience in ICT in education how countries in Africa; provide lessons learnt as well as best practices.

FAWE	To provide an analytical paper on how gender issues are being addressed in various countries within and outside Africa and through FAWES's gender responsive pedagogy.
ICQN-ECD	Provide an analytical paper on preparing children to be ready to learn mathematics, science and ICT and how they are being addressed; provide lessons learnt as well as best practices.
ICQN-TVSD, WGTP and WGBLM	To provide an analytical paper on how to ensure success in learning mathematics, science, technology in primary and secondary education, in technical and vocational education and provide lessons learnt as well as best practices.
WGHE	To prepare an analytical paper on how to promote mathematics, science and technical education at the higher education level and provide lessons learnt as well as best practices.
ICQN-LNL	To prepare an analytical paper on good practices and lessons learnt on promoting mathematics, science and technical education by using national languages and within the context of literacy.
Task force on ICT	▪ Share good practices and lessons learnt on incorporating ICT in the education-learning processes; ▪ To consolidate key issues and learning from the 1st and 2nd Ministerial ICT forums.
WGEMPS	To prepare an analytical paper on good practices and lessons learnt on operational planning, financing and promoting science management and ICT in educational systems, support data collection, analysis and reporting and development of policy briefs.
WGCOMED	Share good practices and lessons learnt on advocacy work and social mobilisation for the promotion of mathematics science and technology in African educational systems. Also provide coverage for the work under sub-theme 2 during the Triennale.
ANCEFA	Support in mobilising the civil society on the Triennale process on sub-theme 2.
Parliamentary Committees on Education from Pilot countries	Kenya's parliamentary committee to be requested to engage with their colleagues in other countries to support and participate in the preparatory process.

7. Thematic summary

To be defined after clear picture of analytical studies have crystallized

8. Working calendar on the sub-theme 2

Date	Activity
24 March 2016	Dispatch methodological notes on sub-theme 2 to ADEA Secretariat and the General Triennial Coordinator.
26 March 2016	General Coordinator sends feedback on the methodological concept notes to sub-theme 2 Coordinator.
31 March 2016	Sub-theme 2 Coordinator shares the methodological note with pilot countries and partner institutions and contract the preparatory work.
8 April 2016	Launch of consultations and preparatory process in pilot countries and in partner institutions.
End of May 2016	Methodological seminar on the first assessment focused on the launch of the different activities and the adjustments to be made.
End of September 2016	Start of analytical work and summary of the studies received and the results of the consultations and other information from the WGs and ICQNs which contribute to sub-theme 2.
End of October 2016	Consultative meeting on the early results of the analytical work; beginning of the analytical work and summary of the results obtained in the WGs and ICQNs coordinating the themes.
End of November 2016	Start of the analytical work and summary of the results obtained regarding the overall coordination.
End of January 2017	Finalisation of the analysis and summary on themes and sub-themes.
15 February 2017	Production of all working documents for the Triennial.

9. Lead partners

1) The Government of Kenya: to lead the whole preparatory process and provide technical, financial and in-kind support including spearheading organisation of consultations

2) Japan International Cooperation Agency (JICA): to provide financial and technical support on Sub-theme 2 throughout the preparatory process and during the triennial

3) African Institute of Mathematical Science (AIMS): Financial and Logistical support and sharing of their work across Africa

10. Budget

To be developed immediately the methodological note is approved

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